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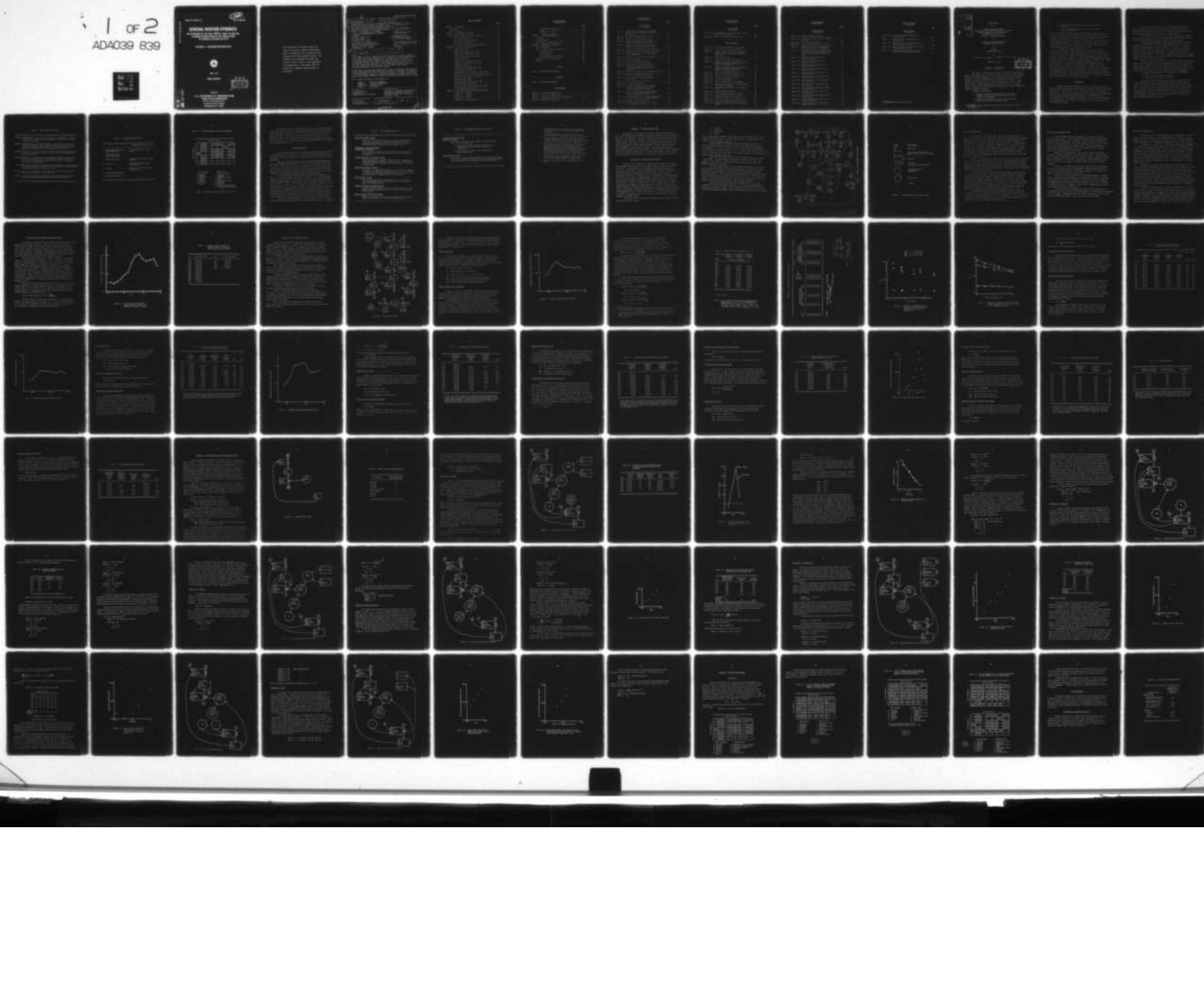

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GENERAL AVIATION DYNAMICS

AN EXTENSION OF THE COST IMPACT STUDY TO INCLUDE DYNAMIC INTERACTIONS IN THE FORECASTING OF GENERAL AVIATION ACTIVITY

VOLUME II. RESEARCH METHODOLOGY

APRIL 1977

FINAL REPORT

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Office of Aviation Policy
Aviation Forecast Branch
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16. Abstract

This report, in four volumes, presents the General Aviation Dynamics (GAD) model which was developed for the Federal Aviation Administration by Battelle's Columbus Laboratories. The GAD model is a dynamic simulation model of the general aviation (GA) system and can be used to forecast GA activity, evaluate alternative policy actions, or perform sensitivity analyses. It has three major sectors, depicting the most important state variables in the model; pilot supply, aircraft utilization, and aircraft demand.

Essentially, the GAD model consists of a set of nonlinear, simultaneous, first order difference equations which explicitly describe the decision policies followed by users of general aviation. The model is designed to be implemented through an interactive computer dialogue feature that guides the analyst through a series of procedures and analytical options.

The volumes included in this report are:

Volume I - Executive Summary
Volume II - Research Methodology
Volume III - Planning Guide
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GENERAL AVIATION DYNAMICS
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VOLUME II. RESEARCH METHODOLOGY

to

FEDERAL AVIATION ADMINISTRATION
OFFICE OF AVIATION POLICY

from

BATTELLE
Columbus Laboratories

by

M. A. Duffy, G. L. Eiden, C. W. Hamilton, and V. J. Drago

December 31, 1976

CHAPTER 1. INTRODUCTION

This report is the result of a series of research programs dealing with the cost impact effects on general aviation conducted by Battelle Memorial Institute - Columbus Laboratories. Past studies were aimed at developing a consistent data base and methodology for determining the influence of cost changes on both numbers of active aircraft and annual hours flown. During these studies, it became apparent that the complex nature of the general aviation system was not being adequately represented with a set of independent, log-linear regression equations.

A method is needed which,

(1) Focuses on general aviation activity at the lowest possible level; that is, by individual user category/aircraft type subsegments,*

(2) Recognizes the important causal interactions between pilots, aircraft, and annual hours flown,

→ next page

* A subsegment is here defined to be a particular user category/aircraft type combination.

cont

(3) Has the ability to assess various policy alternatives quickly, and

(4) Can be easily modified as future forecasting requirements are identified.

This report presents the results of a model development effort designed to satisfy the above objectives. Throughout the report, discussion of the model is couched in the terminology of system dynamics. This method has received considerable attention in recent years as a result of Jay Forrestor's work at the Massachusetts Institute of Technology. The technique dates back 20 years or more, and has been used at Battelle for over a decade, beginning with a regional economic study of the Susquehanna River Basin.

In essence, the computer model consists of a set of nonlinear, simultaneous, first-order difference equations. These difference equations explicitly describe the decision policies followed by users of general aviation. The model can be used to simulate the dynamic (time-dependent) behavior of the general aviation system in response to both exogenous and endogenous disturbances. It cannot be expected to "predict" unforeseen happenings that may occur. It has been stated that a good model is distinguished from a poor one because it captures more of the essence of the system that it presumes to represent. A model of this type can never be really completed. As familiarity is gained with its responsiveness and as more is learned about the real system, improvements will undoubtedly be made. However, this General Aviation Dynamics model should pass the test for being a good model and it is hoped that constructive criticisms can be incorporated to evolve an even better model.

Background

Projections of general aviation activity are published annually by the FAA in the "Aviation Forecasts" series which cover a ten year period. An increasingly important, but difficult, facet of such projections is the assessment of the effects of potential cost changes associated with possible federal regulatory actions. Under two earlier Contracts (Contract Nos. DOT-FA72WA-3118 and DOT-FA74WA-3485) Battelle developed a methodology, data base, and results needed to aid FAA planners in the quantitative assessment of the cost impact of proposed regulatory changes.

In both previous studies, the cost-impact relationships were based upon regression analyses using historical data obtained during a time of relatively steady national economic growth. Furthermore, and more importantly, cost changes were assumed to be restricted to general aviation.

In many cases, the results of these studies were misused. Oftentimes these methods were called upon to establish long term forecasts rather than the short term cost sensitivity analyses for which they were developed.

Frustrations arising from misused forecasting methods, which were reinforced during the 1974 fuel crisis, demonstrated the need for a dynamic simulation model of general aviation activity. In particular, a method was needed which could handle the complex interactions occurring between general aviation, federal agencies, competing modes of transportation, as well as national economic conditions. Difficulties experienced in using past forecasting methods developed outside the FAA, dictated that any new method should be readily accessed and easily used by FAA analysts.

Present FAA forecasting methods use a "top-down" approach for projecting general aviation activity; that is, an aggregate level for total GA activity is forecast and, subsequently, subdivided into various sectors of interest. The method presented here is a "bottom-up" approach providing distinct forecasts for activity within each significant user category/aircraft type subsegment.

Two primary activity measures are forecast for each subsegment:

(1) Number of active aircraft by primary use

(2) Annual hours in service by actual use

Seven distinct user categories within general aviation were chosen for detailed analyses. Table 2-1 provides their standard FAA definitions. Table 2-2 defines the seven different aircraft types that are included in the model. The choice of seven user categories and seven aircraft types provides for a possible 49 different combinations. However, many of these possible subsegments have little or no recorded activity. Therefore, throughout this report reference will be made to the 29 significant user category/aircraft type subsegments identified in Table 2-3.

TABLE 2-1. USER CATEGORY DEFINITIONS

BUSINESS TRANSPORTATION - Any use of an aircraft not for compensation or hire by an individual for the purposes of transportation required by a business in which he is engaged.

CORPORATE TRANSPORTATION - (previously Executive) - Any use of an aircraft by a corporation, company or other organization for the purposes of transporting its employees and/or property not for compensation or hire and employing professional pilots for the operation of the aircraft.

PERSONAL FLYING - Any use of an aircraft for personal purposes not associated with a business or profession, and not for hire. This includes maintenance of pilot proficiency.

AERIAL APPLICATION - Aerial application in agriculture consists of those activities that involve the discharge of materials from aircraft in flight and a miscellaneous collection of minor activities that do not require the distribution of any materials.

INSTRUCTIONAL FLYING - Any use of an aircraft for the purposes of formal instruction with the flight instructor aboard, or with the maneuvers on the particular flight(s) specified by the flight instructor.

AIR TAXI - Any use of an aircraft by the holder of an Air Taxi Operating Certificate which is authorized by that certificate.

OTHER - Any use of an aircraft not accounted for by the previous use categories. Note that this includes industrial/special and rental operations.

TABLE 2-2. AIRCRAFT TYPE DEFINITIONS

	Predominant Aircraft Class
1. Single-engine piston non aerial application	Single-engine piston 4-place and over
2. Single-engine piston aerial application	
3. Multi-engine piston	Twin-engine piston under 12,500 lb TOGW
4. Turboprop	Twin-engine turboprop under 12,500 lb TOGW
5. Turbojet	Twin-engine turbojet/fan under 20,000 lb TOGW
6. Piston-engine helicopter	
7. Turbine-engine helicopter	

TABLE 2-3. SIGNIFICANT GENERAL AVIATION SUBSEGMENTS

User Category I	Aircraft Type J 1	2	3	4	5	6	7
1		X		X	X		X
2		X				X	
3		X		X	X		X
4	X			X	X		X
5		X		X	X		X
6		X					
7		X					

USER CATEGORY

1. Business
2. Corporate
3. Personal
4. Aerial
5. Instruct.
6. Air Taxi
7. Other

AIRCRAFT TYPE J

1. Single-Eng. Piston Nonaerial
2. Single-Eng. Piston Aerial
3. Multi-Engine Piston
4. Turboprop
5. Turbojet
6. Piston Engine Helicopter
7. Turbine Engine Helicopter

NOTE: X denotes insignificant amount of activity.

During the previous Cost Impact studies, major cost centers were defined for both the variable cost of aircraft operation and the fixed cost associated with aircraft ownership. Definitions for cost centers used in the present study are given in Table 2-4. The concept of annualized investment reverts back to the original Cost Impact study, because the only historical data available are based upon this definition. All cost center data have been obtained from reports prepared by Aviation Data Service, Inc.

Model Perspectives

In the following chapters, the General Aviation Dynamics (GAD) model will be discussed in detail. However, some of the major differences between this model and other forecasting methods should be recognized before delving further into the development.

First, it should be understood that the General Aviation Dynamics model has its own strengths and weaknesses. A model of this type cannot be all things to all users. Models reflect the specific purposes for which they were designed and the particular techniques selected. Inclusion of variables and interactions within a model is tantamount to recognizing their explanatory value, while omitted parameters are regarded as unimportant for the specified objectives.

Second, although the General Aviation Dynamics model represents (we believe) a significant advance in the state of the art, it still has considerable room for future improvement. Some parts of the model are more thoroughly understood than others. This is partly because of data availability and partly because of the more stable behavior of certain subsegments of general aviation. For this reason, the model is better judged according to its overall structure, rather than by scrutiny of its individual parts. Indeed, in depth analyses of each sector within the model could provide the basis for entire research programs themselves. The real significance of the model is in the structure which defines the causal interactions between various components of the entire general aviation system.

Third, the following differences between the General Aviation Dynamics (GAD) model and other general aviation forecasting techniques should be considered:

TABLE 2-4. COST CENTER DEFINITIONS

FUEL AND OIL COSTS ($/HOUR)

Fuel and oil cost per hour are based on the average consumption rate at 75 percent power. Airframe and engine manufacturers recommended fuel type were used for all calculations. The Fuel and Oil Cost Center includes state and federal fuel tax.

AIRFRAME AND AVIONICS MAINTENANCE AND OVERHAUL COST($/HOUR)

This cost center includes all labor and parts costs associated with scheduled and unscheduled airframe and avionics maintenance and overhaul.

ENGINE MAINTENANCE AND OVERHAUL ($/HOUR)

Engine maintenance and overhaul includes costs for scheduled and unscheduled engine maintenance, overhaul, 100 hour, 1000 hour, and/or annual inspections. Includes also midpoint and cycle costs for turbine engines.

ANNUALIZED INVESTMENT ($/YEAR)

The purpose of the annualized investment cost center is to represent an annual dollar amount for ownership cost of the aircraft itself. A straight line annualizing schedule applied to the aircraft's first year retail price, including sales tax, has been used.

HULL INSURANCE ($/YEAR)

Hull insurance cost is the annual premium paid to insure the aircraft against damage while in motion or at rest. A deductible amount is normally included.

LIABILITY AND MEDICAL INSURANCE($/YEAR)

Liability insurance premiums are paid to insure the aircraft owner against damage to persons or property by reason of his operation of the aircraft.

HANGAR, STORAGE AND TIE DOWN ($/YEAR)

Hangar, storage and tie down rates are averaged from known regional hangar rates, parking fees, and manufacturer suggested rates.

TABLE 2-4. COST CENTER DEFINITIONS (Continued)

FEDERAL REGISTRATION FEE AND WEIGHT TAX ($/YEAR)

The Federal registration fee and weight tax went into effect July 1, 1970. The rates are:

- Reciprocating powered aircraft - $25 plus $0.02 per pound for aircraft of gross weight over 2,500 pounds.
- Turbine powered aircraft - $25 plus $0.035 per pound of gross weight.

MISCELLANEOUS ($/YEAR)

Miscellaneous costs include allowance for the state aircraft registration fees, training, catering, landing fees, navigation materials, airworthiness directive requirements and minor modifications.

1. GAD produces forecasts of activity by disaggregating general aviation into 29 user category/aircraft type subsegments.
2. Causal relationships are included which describe the interrelationships between pilots, aircraft, and flying.
3. GAD has a highly detailed pilot supply sector which recognizes changes in U. S. population and the progression of pilots through increased levels of proficiency.
4. GAD recognizes that it is the rates of flow of people and aircraft into and out of the system that must be understood in order to perform meaningful policy evaluation. These rates of flow represent the decisions made within the system, and it is the formulation of these decision policies that is the objective of regression analyses performed during model development.
5. GAD is fully capable of evaluating federal policy alternatives that can be translated into either fixed or variable cost changes to general aviation users.
6. GAD is fully automated with real-time analysis capability.

CHAPTER 2. AN OVERVIEW OF THE MODEL

The purpose of this chapter is to give the reader a brief overview of the entire General Aviation Dynamics model before the details of each individual model sector are presented. There are three major sectors representing the most important state variables in the model: pilot supply, aircraft utilization, and aircraft demand. The aircraft utilization and aircraft demand sectors are tied together by important negative feedback loops for some user category/aircraft type subsegments. In many cases, the demand for an active aircraft stock is derived from conditions within other sectors. Other subsegments display essentially (as yet) uncontrolled positive growth. The pilot supply sector exhibits a one-way causal influence on both numbers of active aircraft and annual hours flown.

Structure of the General Aviation System

The first step in modeling the general aviation system is to choose a system boundary that defines the concepts which interact to produce the behavior of interest. Interest here is in the mechanisms that foster the growth of general aviation activity. The model should be able to forecast a baseline for uncontrolled general aviation activity over at least a ten year period. It should also be capable of forecasting activity if government controls are imposed in order to either inhibit or enhance general aviation activity. It cannot pretend to predict unforeseen circumstances which might greatly alter the normal system behavior. However, the model should be able to answer "what if" questions concerning its environment. Limiting attention to a ten year forecast should preclude effects of widespread commercialization of any (as yet) unknown technological development. The general aviation model developed herein is representative of the aggregate level of activity within the U. S. It was not constructed for the purpose of forecasting activity on a regional basis; although it should be adaptable to regional studies.

Three levels (state variables) were chosen as the cornerstones on which to build the system structure:

- Aircraft
- Hours flown
- Pilots

Each of these levels represents the principal variable in a major sector of the general aviation structure. The three levels interact in multiple ways. The entire structure is shown in Figure 2-1.

System dynamics flow diagram symbols are summarized in Figure 2-2. The system levels appear as rectangles. Note that the active aircraft level is subscripted i, j. This is to indicate that active aircraft are distinguished by the number of aircraft of type j (j = 1,2,...7) within user category i(i=1,2,...7). Table 2-3 identifies the 29 particular user category/aircraft type subsegments which are explicitly contained in the model.

Rates are the system's action or policy variables that effect changes in the levels. Aircraft activation, destruction and utilization rates control general aviation activity. Airman certificate issuances and departure rates determine active pilot population.

Since the rates acting on a level summarize the effects of all factors which influence the state of that level, they are generally complex expressions. Often one or more components of a rate are sufficiently important to warrant individual attention. These auxiliary variables are separated algebraically from the rate equation, and are represented pictorially as circles. One such auxiliary variable is the desired-active-aircraft, which represents the goal that each subsegment is striving to achieve under the present system conditions.

Dotted lines are used to indicate an information flow or a causal influence in the direction shown by the arrows. Solid lines represent physical flows such as aircraft or people. Arrows located on either side of a rate (e.g. aircraft activation rate), indicate that the rate can be either positive or negative.

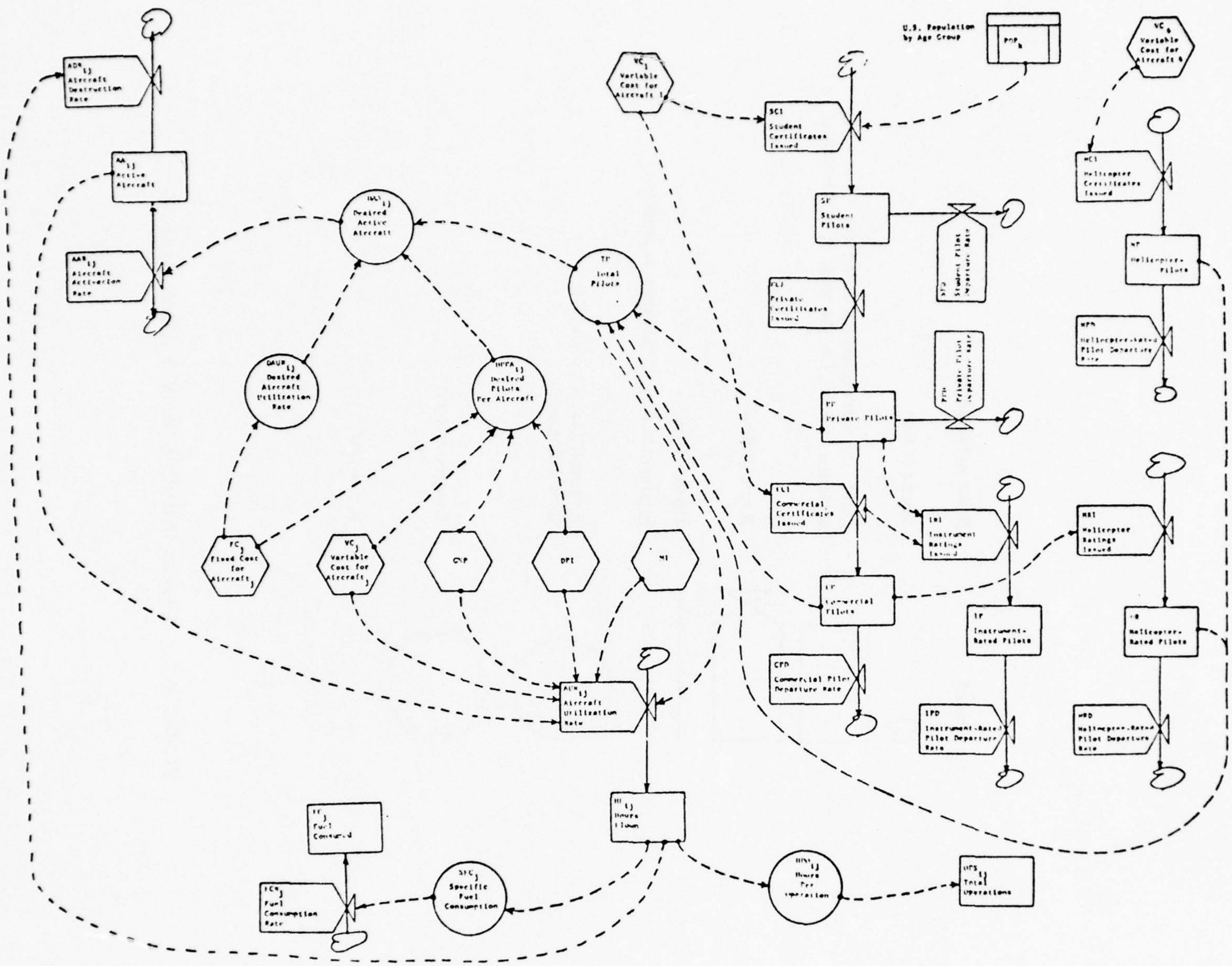

FIGURE 2-1. GENERAL AVIATION DYNAMICS FLOW DIAGRAM

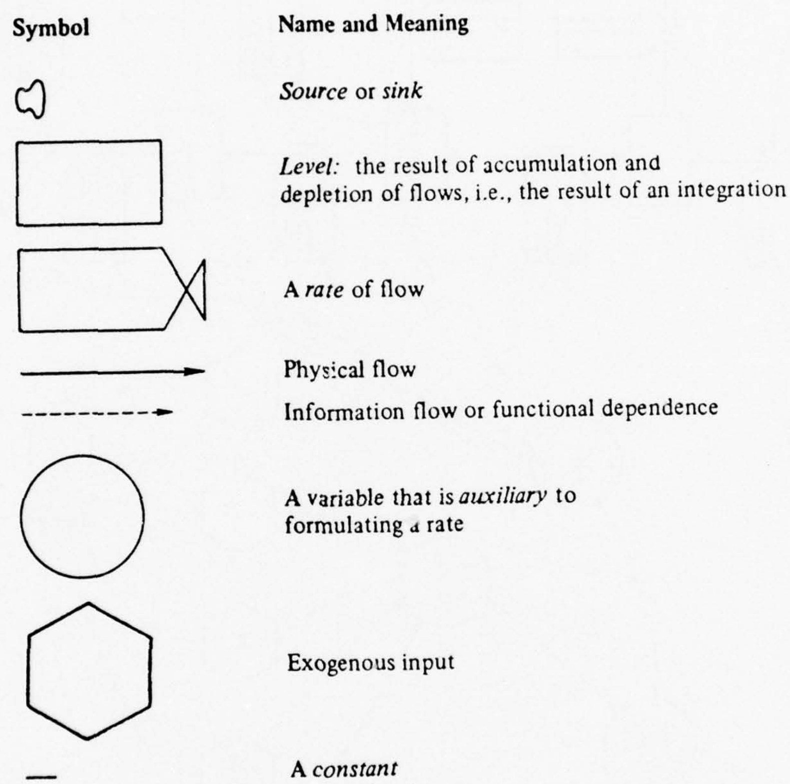

FIGURE 2-2. SYSTEM DYNAMICS FLOW DIAGRAM SYMBOLS

The Pilot Supply Sector

The simplest of the model's major sectors in a conceptual sense is the pilot supply sector. Only two factors, certificates issued and pilot departures are involved directly in pilot population change. Two important elements in the determination of certificates issued are U. S. population and a relative measure for the cost of obtaining a certificate. Because of a lack of better data, the variable cost of operating a single-engine piston aircraft was used as a measure of the relative increase in total outlay for an upgraded certificate. Because of the importance of age structure in obtaining student certificates, the total U. S. population is disaggregated into three age classes; 16-24 years, 25-34 years, and over 35 years old.

Figure 2-1 illustrates how flows into and out of a given airman certificate class occur over time. People enter a pilot class by earning an upgraded certificate after achieving the previous certificate type. People leave a pilot class by upgrading to the next higher certificate type or by departing the system altogether. Additional ratings (viz. instrument and helicopter) are, of course, held simultaneously with a valid airman certificate type.

The most important mechanism within the pilot supply sector is the rate of student certificates issued. An increase in student certificates issued will result in an instantaneous increase in student pilots, but will have a delayed reaction before causing an increase in private pilots, and an even longer delay before increasing commercial pilots. On the other hand, a constant rate of student certificates issued will shortly produce a constant level of private pilots, and eventually a constant level of commercial pilots. This has been the situation regarding the issuance of student certificates during the past few years.

The importance of the way in which progression takes place within the pilot supply sector is stressed here because most pilot forecasting methods try to forecast the number of different pilot types independently. Since pilot upgrading and departing occurs continuously over time, the present approach should yield a better "feel" for the true behavior within this sector.

The Aircraft Utilization Sector

Several different behavioral subsegments are evident within the aircraft utilization sector. First is the owner-operator situation, characterized by the business and personal use categories. Here an aircraft is purchased and operated by the same individual. The average annual utilization rates for these aircraft have been varying about a nominal value. Total annual utilization within each of these subsegments is obtained by taking the product of active aircraft and average annual utilization rate.

Demand for aerial application, instructional, and air taxi flying represents an aggregate demand for a general aviation service. The total annual hours demanded are distributed among the available aircraft to determine a derived annual utilization rate. As will be discussed later, these derived utilization rates will be used in determining the demand for additional aircraft in these categories.

Behavior of the single and multi-engine piston aircraft owners within the "other" use category, which are predominantly rental operations, is similar to the total hours flown approach. The remaining segments of the "other" use category are based on average utilization rates.

Different user category/aircraft type subsegments respond to different stimuli. Utilization, either average rate or total hours, has shown a significant correlation with variable cost of operation in only a few of the 29 subsegments. Some subsegments have indicated utilizations dependent on GNP, DPI, or the level of commercial air activity. However, the form of these dependencies is, in some cases, opposite the a priori expectation.

The forecasted level of annual hours flown is used to determine the corresponding level of operations within each subsegment. Operations are distinguished by local-itinerant, towered-non-towered, and IFR-VFR. Annual hours flown is also used in calculating the amount of both piston and jet fuel consumed.

The Aircraft Demand Sector

The structure of the aircraft demand sector is identical for all subsegments of general aviation. Each subsegment has its own goal for a desired number of active aircraft which it is striving to achieve. The main difference between subsegments is in the functional expression for their respective goals.

The demand for aircraft that are owned and operated by the same individual (viz. business and personal user categories), is likely to be dependent on the supply of active certificated pilots. As the number of active pilots increases, the demand for active (business and personal) aircraft will increase. This is expressed through the desired-pilots-per-aircraft ratio. However, in certain cases, the desired-pilots-per-aircraft parameter is shown to be a function of total cost of operation and either GNP or DPI. Thus, as the relative economic attractiveness of owning an aircraft goes down, the same number of pilots will demand fewer aircraft.

The demand for aircraft that are used in providing a service (viz. aerial application, instructional, air taxi and rental) is dependent on the extent to which these aircraft are presently being used. Should the average annual utilization rate of a particular aircraft type within one of these user categories surpass some threshold, then there will be a need for additional aircraft to satisfy what may be an excess demand. The goal for desired number of active aircraft is related to the ratio of desired aircraft utilization rate and actual aircraft utilization rate. Except for aerial applications, the desired aircraft utilization rates within other subsegments have been insensitive to changes in economic variables.

Demand for corporate aircraft is based on a desired number of active aircraft which is directly related to general economic conditions. Intuitively, this functional dependence is appealing. For, should economic growth be stagnated and real GNP remain constant, the desired number of corporate aircraft will remain constant. Ultimately, the demand for additional corporate aircraft would represent only replacement of destroyed aircraft. However, if the economy continues to grow, an ever increasing number of active corporate aircraft will be desired.

A Level of Service Index for Commercial Aviation

The purpose of including a level of commercial aviation service in the general aviation dynamics model was to provide an approximate measure of substitutability between the two modes of travel. More precisely, the intent was to relate time rates of change in general aviation activity levels (hours flown, active aircraft) to potentially impacting rates of change in scheduled air carrier operations. In particular, the commercial aviation level of service index influences activity levels for the corporate use category.

Level of service is taken here to connote a measure of the quantity of service offered by commercial aviation. As such, it serves as a surrogate measure for the probability of the availability of direct service for a trip demand between two arbitrary points (origin - destination) at an arbitrary origination time. This probability depends on three principal attributes of the commercial aviation system: (1) average flight frequency, (2) number of airports served, and (3) the number of direct service routes making up the air carrier network. These factors, in turn, depend on policies and practices pertaining to (1) average load factor, (2) aircraft payload capacity, and (3) route network configuration. It should be noted that level of service is independent of cost.

Based on the foregoing conceptualization of level of service, revenue aircraft departures in scheduled domestic service for certificated route air carriers (RAD) is used in the model as a reasonable surrogate measure of the desired probability. As used in the model, this index is expressed as a proportional change from the model base year, i.e.,

$$\text{Level of Service Index for Year } t = \frac{RAD(t)}{RAD(1972)}$$

Absolute values for revenue aircraft departures for the time period 1961-1974 are given in Figure 2-3 and Table 2-5. It is seen from these figures that revenue aircraft departures increased sharply through the decade of the 60s, followed by a significant decline between 1969 and 1974.

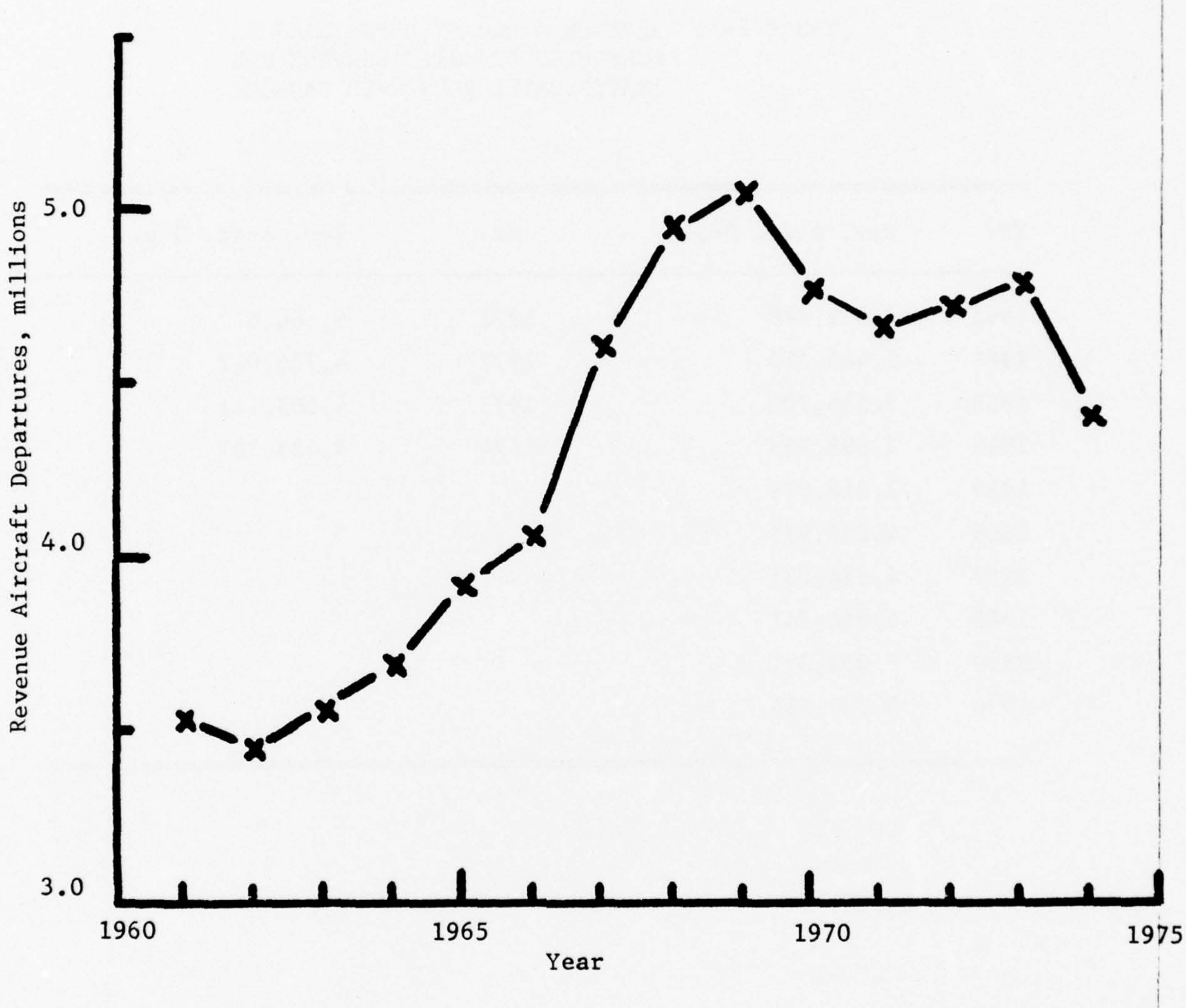

FIGURE 2-3. REVENUE AIRCRAFT DEPARTURES IN SCHEDULED DOMESTIC SERVICE FOR CERTIFICATED ROUTE AIR CARRIER

TABLE 2-5. REVENUE AIRCRAFT DEPARTURES IN SCHEDULED DOMESTIC SERVICE FOR CERTIFICATED ROUTE AIR CARRIER

Yr.	Rev. Acft. Dep.	Yr.	Rev. Acft. Dep.
1961	3,532,448	1971	4,680,612
1962	3,445,720	1972	4,726,047
1963	3,556,700	1973	4,805,141
1964	3,692,959	1974	4,433,387
1965	3,916,616		
1966	4,070,971		
1967	4,624,031		
1968	4,956,741		
1969	5,058,371		
1970	4,776,584		

CHAPTER 3. THE PILOT SUPPLY SECTOR

There are three classes of certificated pilots which are of major importance to general aviation. In order of the required steps for progression these are holders of student, private, and commercial certificates. Airline transport pilots have been disregarded since they represent a relatively small fraction of the total. Helicopter pilots are included because they are important in determining the number of active helicopters.

To obtain a student certificate, an applicant must be at least sixteen years of age and must have passed an FAA-approved medical examination within the previous two years. Thereafter, medical examinations are required biennially to maintain the validity of the license.

This continues to be necessary after he has obtained his private pilot's license, which in turn also requires that he should be at least seventeen years of age and have passed the necessary proficiency tests, and had at least forty hours of flying experience.

To obtain a commercial license the private pilot has to be at least eighteen years old and be able to demonstrate a higher level of proficiency in written and practical examinations. He must have had at least 200 hours of flying time, with a specified proportion of instructional and other experience. Medical examinations for commercial pilots are required annually.

In addition to these types of certificates, instrument ratings and helicopter ratings held by these pilots are also of importance.

Figure 2-4 shows the chosen model of the pilot supply sector. By the nature of its construction, the model asserts that the relationships chosen for inclusion are important, that any omitted relationships are less important, and the "real world" interactions can be represented usefully as described in the details of the model.

All of the data used in quantifying the relationships within the pilot supply sector have been obtained from various issues of the FAA Statistical Handbook of Aviation.

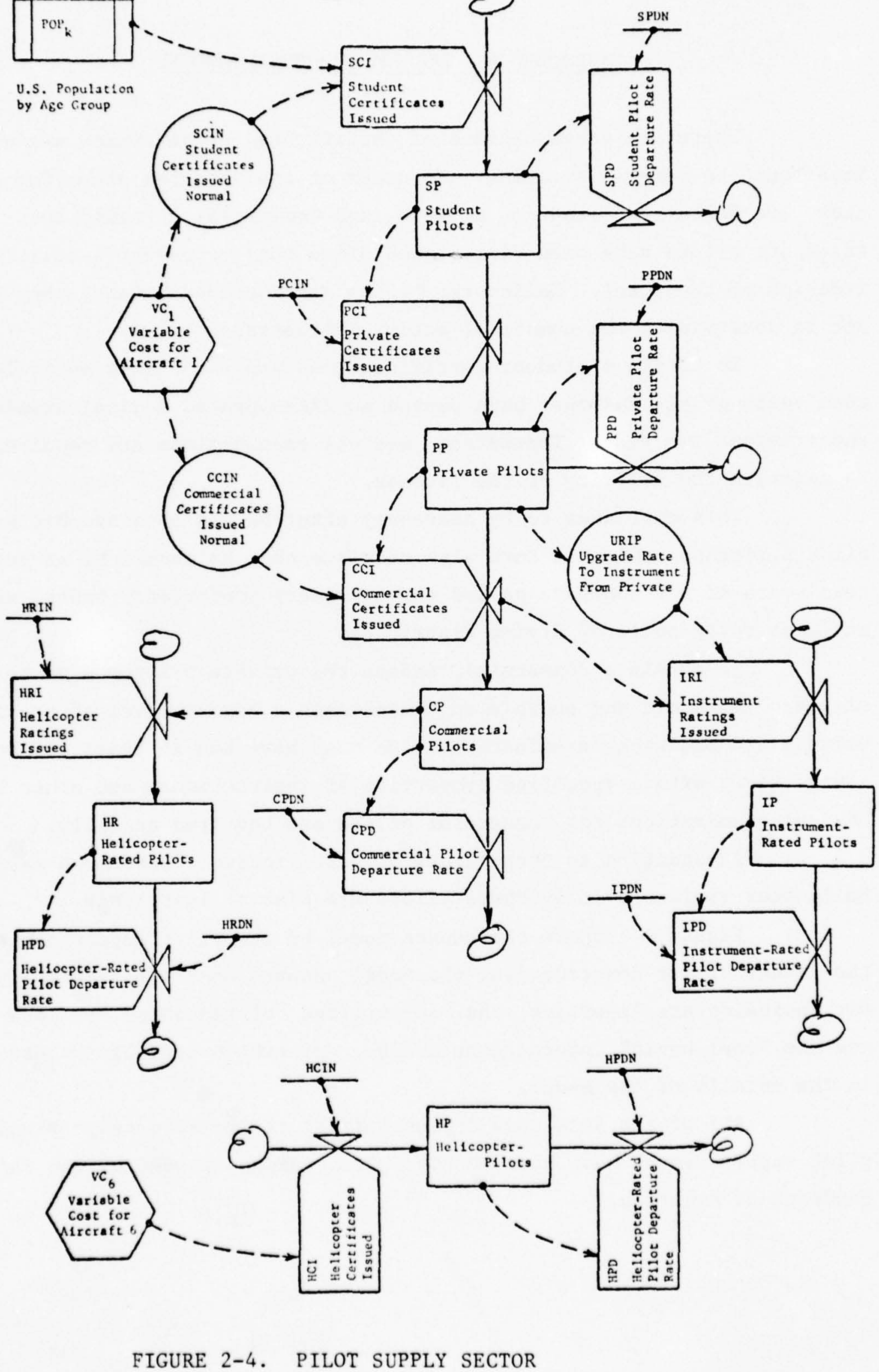

FIGURE 2-4. PILOT SUPPLY SECTOR

As depicted, the pilot supply sector possesses no feedback mechanisms, only "feed-forward". This implies a stable situation which is neither growing nor decaying at an excessive rate. It may be argued that "pilots beget pilots" which would imply a positive feedback and exponential growth. However, this has been assumed not to be the case.

Student Pilots (SP)

Student pilots in Figure 2-4 is a system "level" variable. Student pilots at any point in time are calculated as the student pilot population at the preceding point in time, plus the number of student certificates issued during the intervening interval, minus the number of private certificates issued, minus the student dropouts. Mathematically this is expressed as

$$SP_t = SP_{t-1} + DT(SCI - PCI - SPD)$$

SP_t: Student pilots at time t (people)

DT: Time interval, DT = (t) - (t-1) (years)

SCI: Rate of student certificate issuances (people/year)

PCI: Rate of private certificate issuances (people/year)

SPD: Rate of student pilot departures (people/year)

Student Certificates Issued (SCI)

Figure 2-5 is a plot of the student certificates issued during each year since 1964. The mid-60s experienced a tremendous growth in the number of certificates issued annually. Through the late-60s and into the 70s, the number of certificates issued decreased and essentially leveled out.

This phenomena may be explained by noting that the general aviation pilot boom of the mid-60s was the result of persons in all age groups obtaining initial certification. As time progressed these older age groups became saturated, to the extent that most persons in an older age group who desired to become a pilot would already have done so. Thus, for the most part, student certificates issued now are to persons just becoming of available age or financially able.

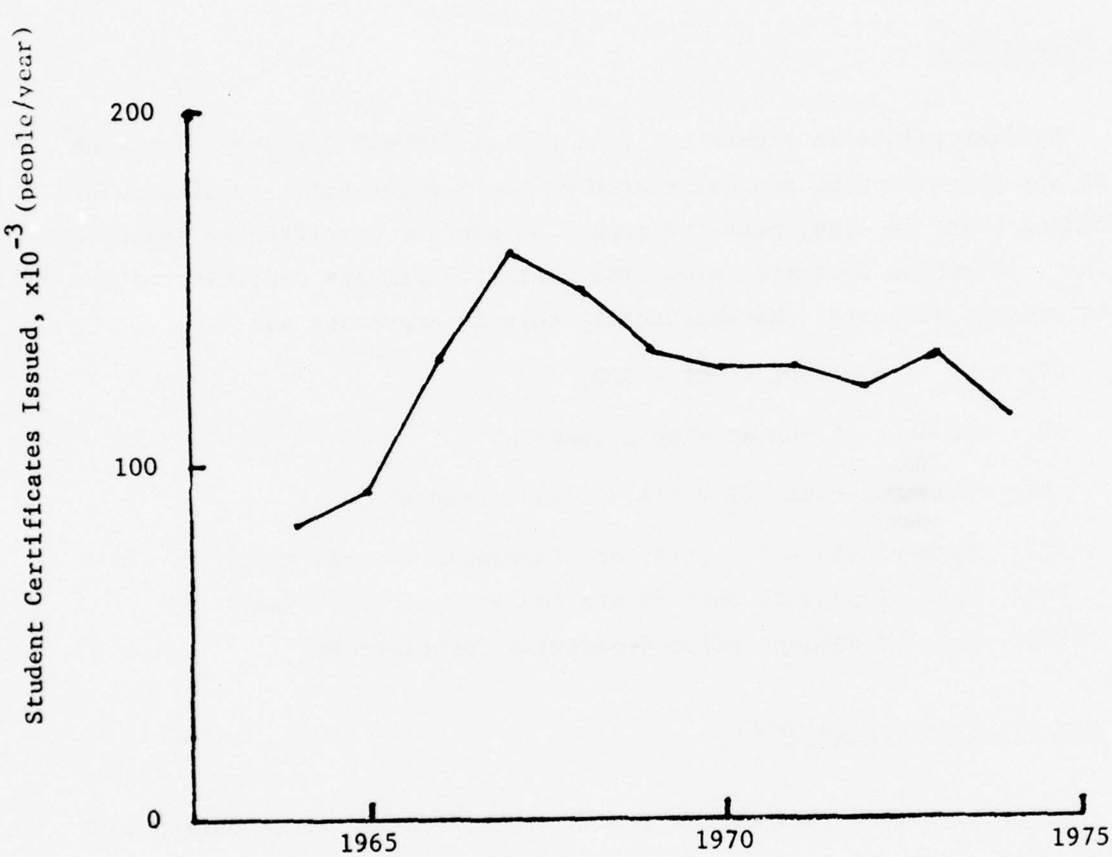

FIGURE 2-5. STUDENT CERTIFICATES ISSUED ANNUALLY

The estimated resident population of the U. S. is presented in Table 2-6 for each of three age groups over the past ten years. Table 2-7 presents data on the fraction of student certificates held by members of these three age groups as of January 1, 1970-1974, the total number of student certificates issued during the previous year, and the fraction of available population within each age group obtaining a certificate. For example

$$SCIN(1) = .00162 = \frac{.371 \times 132,926}{30,433,000} .$$

The issuance of student certificates is most likely a relatively stable situation now that the initial boom period has passed. Therefore, the rate of issuance should be related to the level of individual affluence and the relative cost of obtaining a private certificate. Specifically, the influence of disposable personal income per capita (DPI) and variable cost of operating single engine piston aircraft [VC(1)] on the rates of issuance were investigated. Since no historical data on the absolute cost of obtaining the various certificates could be found, VC(1) was chosen as a relative indicator for the total cost of obtaining a certificate. Figure 2-6 illustrates the relationship between SCIN(K) and VC(1).

Linear regression equations were developed by first indexing the variable cost (1972 value = 1) as displayed in Figure 2-7. Both VC(1) and DPI were included as independent variables in a stepwise linear regression analysis. The most significant results were

$$SCIN(1) = 0.00448 - .00292 \frac{VC(1)}{VC(1)_{1972}}$$

$$R^{2*} = .90;\ F_{1,4}^{**} = 37.3$$

$$SCIN(2) = 0.00348 - .00208 \frac{VC(1)}{VC(1)_{1972}}$$

$$R^2 = .83;\ F_{1,4} = 19.6$$

$$SCIN(3) = 0.000742 - .000324 \frac{VC(1)}{VC(1)_{1972}}$$

$$R^2 = .64;\ F_{1,4} = 7.25$$

---

* R^2, the coefficient of determination, is interpreted as the proportionate reduction of total variation associated with the use of the independent variable.

** $F_{1,4}$, the ratio of two χ^2 variables, is the test statistic in an analysis of variance approach for testing the validity of the regression equation. $F_{1,4} = 37.3$ indicates that the coefficient of the independent variable is significant at the 0.005 level.

TABLE 2-6. ESTIMATED RESIDENT POPULATION OF U. S.

	POP(1)	POP(2)	POP(3)
As of July 1	16-24	25-34	35+
	Numbers In Thousands		
1965			
1966	27,777	22,483	82,406
1967	28,609	22,896	83,145
1968	29,394	23,700	83,770
1969	30,433	24,406	84,330
1970*	31,733	25,079	85,076
1971	33,194	25,652	85,756
1972	33,619	27,243	86,442
1973	34,336	28,458	87,144
1974	35,053	29,625	87,882
1975	35,778	30,783	88,703

* P-25, No. 614.

Source: U. S. Bureau of the Census, Current Population Reports, Series p-25, No. 519. "Estimates of the Population of the United States by Age, Sex, and Race: April 1, 1960, to July 1, 1973", U. S. Government Printing Office, Washington, D.C., 1974.

TABLE 2-7. STUDENT CERTIFICATES BY AGE GROUP

As of Jan. 1	Fraction of Student Cert. in Each Age Group			Student Cert. Issued Previous Year	Fraction of Available Population Obtaining A Student Cert. Previous Yr.		
					SCIN(1)	SCIN(2)	SCIN(3)
	16-24	25-34	35+		16-24	25-34	35+
1970	.371	.347	.282	132,926	.00162	.00190	.000444
1971	.384	.333	.283	126,971	.00154	.00168	.000422
1972	.373	.334	.293	128,004	.00144	.00167	.000437
1973	.364	.337	.299	121,543	.00132	.00150	.000420
1974	.372	.339	.289	131,384	.00142	.00156	.000436
1975	.372	.341	.287	113,997	.00121	.00131	.000372

Example

As of Jan. 1, 1970

During 1969

$$.00162 = \frac{.371 \times 132{,}926}{30{,}433{,}000}$$

July 1, 1969

$$SPBN = \hat{a} + \hat{b}\, e^{-t} \quad .$$

$$SCIN(1) = .00134 + .00031e^{-t}$$

$$SCIN(2) = .00149 + .00044e^{-t}$$

$$SCIN(3) = .000422$$

Note: $t = 0$ at January 1, 1970

$t = 1$ at January 1, 1971

Etc.

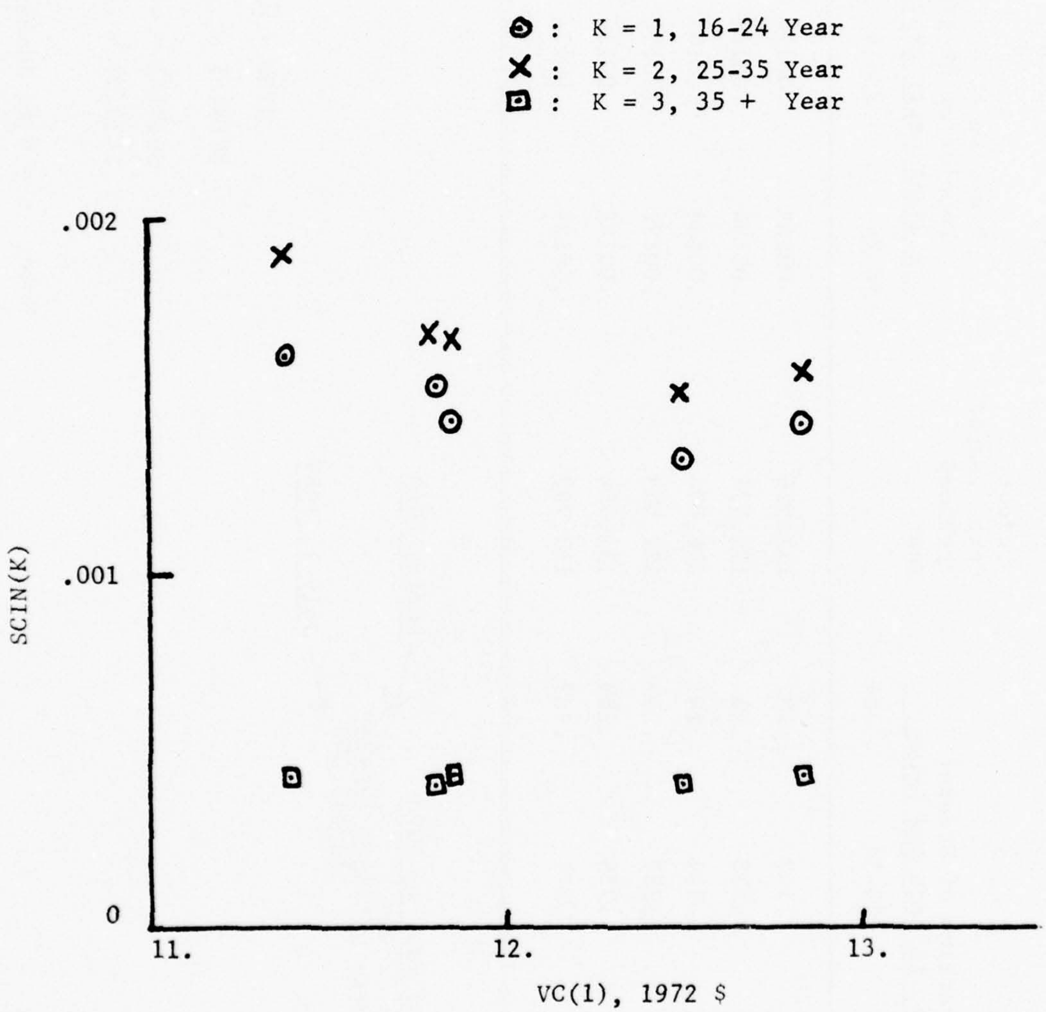

FIGURE 2-6. FRACTION OF AVAILABLE POPULATION OBTAINING STUDENT CERTIFICATES (PER YEAR) AS A FUNCTION OF VARIABLE COST

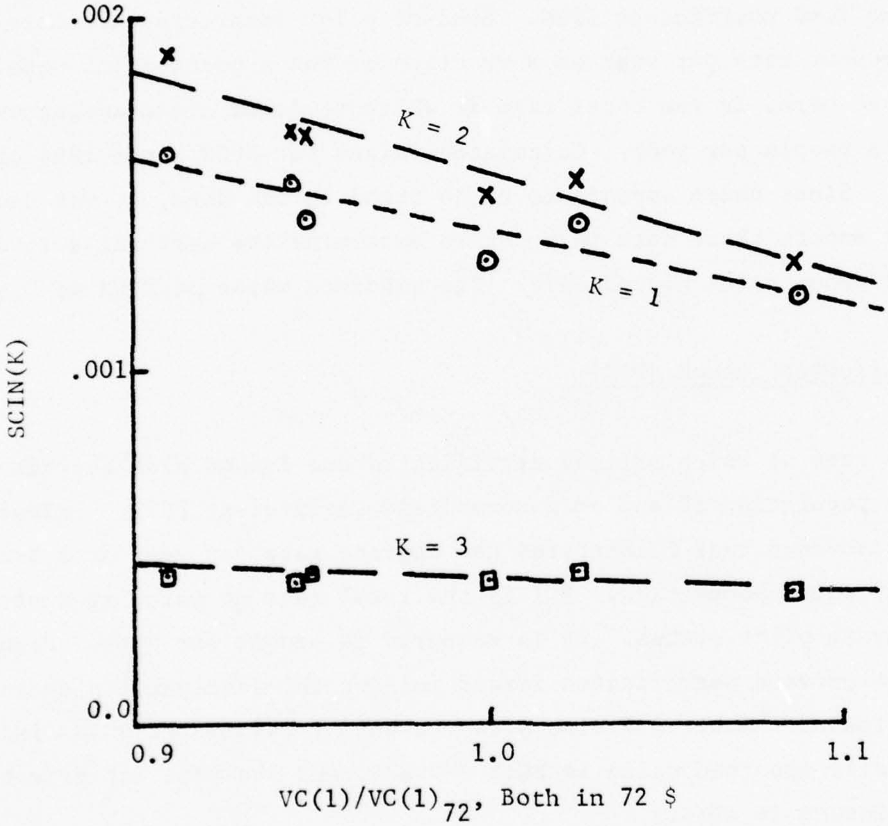

FIGURE 2-7. FRACTION OF AVAILABLE POPULATION OBTAINING STUDENT CERTIFICATES (PER YEAR) AS A FUNCTION OF VARIABLE COST INDEX

The rate of student certificate issuance is then

$$SCI = \sum_{I=1}^{3} SCIN(I)*POP(I)$$

where POP(I) is the total population within the Ith age group.

Student Pilot Departure Rate (SPD)

Student pilot departure rate depends on the student pilot population SP and on a normalized coefficient SPDN. Student pilot departure rate normal SPDN states the dropout rate per year as a fraction of the student pilot population. SPD, as defined here, is the total rate at which students are dropping out. It is measured in people per year. Calculated values for SPDN since 1964 are presented in Table 2-8. Since there appears to be no trend in the data, it was decided to exponentially smooth these data in order to determine the best value to use in forecasting dropout rates beyond 1975. The smoothed value of SPDN is 0.409.

Private Certificates Issued (PCI)

The rate at which private certificates are issued also depends on the student pilot population SP and on a normalized coefficient PCIN. Private certificates issued normal PCIN states the upgrade rate per year as a fraction of the student pilot population. PCI is the total rate at which students are achieving private pilot status. It is measured in people per year. Figure 2-8 shows that private certificates issued follows the same pattern as student certificates issued. Table 2-8 also presents annual values for PCIN since 1964. The exponentially smoothed value is PCIN = 0.274, and the rate for private certificates issued is simply

$$PCI = PCIN*SP$$

If the reciprocal of SPDN + PCIN is formed, the result will be the average "life expectancy" of a student pilot. Substituting in the smoothed values yields an average student pilot lifetime of 1.46 years. This seems entirely reasonable in view of the fact that a student certificate is only valid for two years.

TABLE 2-8. STUDENT PILOT DEPARTURE RATE NORMAL AND PRIVATE CERTIFICATES ISSUED NORMAL

	1. Student Certificates As of Jan. 1	2. Student Certificates Issued During	3. Private Certificates Issued During	4. Student Departures During	(4÷1) SPDN	(3÷1) PCIN
1975	180,795					
1974	181,905	113,997	48,501	66,606	.366	.267
1973	181,477	131,384	53,140	77,816	.429	.293
1972	186,428	121,543	50,523	75,971	.408	.271
1971	195,861	128,004	49,579	87,858	.448	.253
1970	203,520	126,871	53,026	81,504	.400	.261
1969	209,406	132,926	54,597	84,215	.402	.261
1968	181,287	149,444	54,232	67,093	.370	.299
1967	165,177	159,399	57,520	85,769	.519	.348
1966	139,172	129,180	42,464	60,711	.436	.305
1965	120,743	94,635	33,337	42,869	.355	.276
1964	105,298	84,629	26,425	42,759	.406	.251

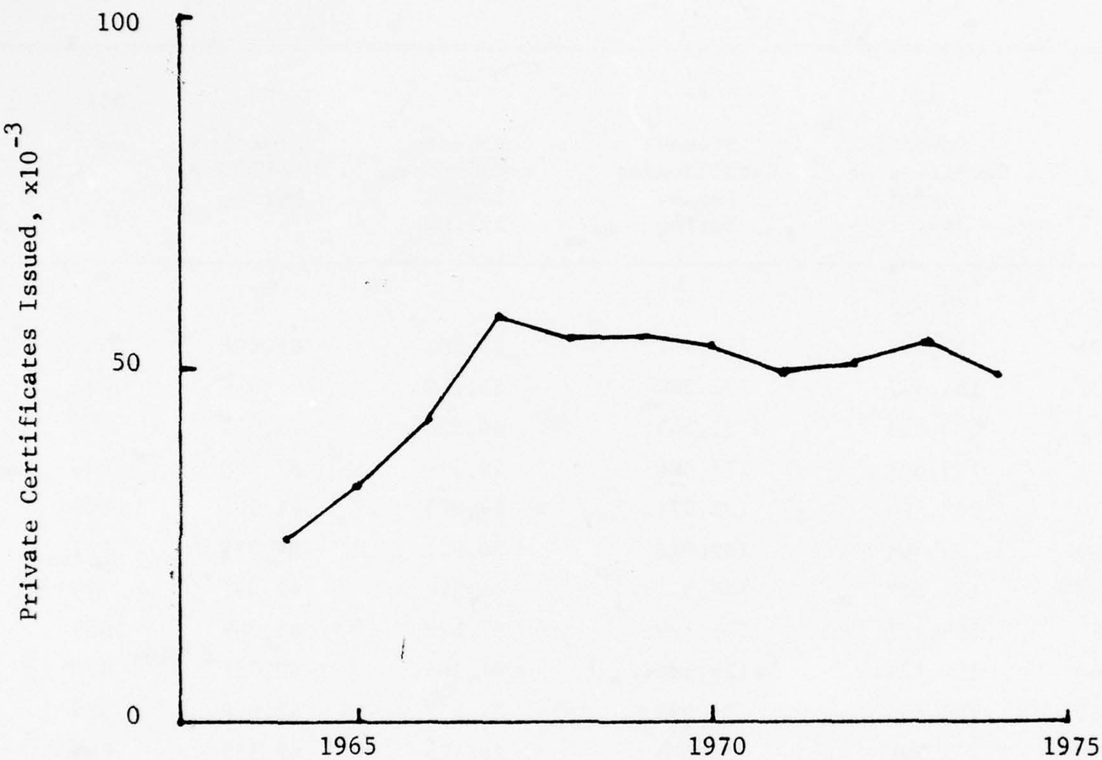

FIGURE 2-8. PRIVATE CERTIFICATES ISSUED ANNUALLY

Private Pilots (PP)

Private pilots PP at any point in time is calculated as the private pilot population at the preceding point in time, plus the number of private certificates issued during the intervening interval, minus the number of commercial certificates issued, minus the private pilot departures.

$$PP_t = PP_{t-1} + DT(PCI - CCI - PPD)$$

PP_t: Private pilots at time t

CCI: Rate of commercial certificates issued

PPD: Rate of private pilot departures

Private Pilot Departure Rate (PPD)

Private pilot departure rate PPD is calculated according to

$$PPD = PPDN * PP$$

where the private pilot departure rate normal (PPDN = 0.062) is an exponentially smoothed average of the annual values presented in Table 2-9.

Commercial Certificates Issued (CCI)

The rate at which commercial certificates are issued depends on the private pilot population PP and on a normalized coefficient CCIN. Commercial certificates issued normal CCIN states the upgrade rate per year as a fraction of the private pilot population. CCI is the total rate at which private pilots are progressing to commercial pilot status. Historical data for CCI, measured in people per year, is plotted on Figure 2-9. Table 2-9 presents annual values for CCIN since 1964. The exponentially smoothed value is CCIN = 0.065. However, in a manner similar to SCIN(K), the normal rate of issuance for commercial certificates was found to depend on variable cost

TABLE 2-9. PRIVATE PILOT DEPARTURE RATE NORMAL AND COMMERCIAL CERTIFICATES ISSUED NORMAL

	1. Private Certificates As of Jan. 1	2. Private Certificates Issued During	3. Commercial Certificates Issued During	4. Private Pilot Departures During	(4÷1) PPDN	(3÷1) CCIN
1975	305,848					
1974	298,921	48,501	17,693	23,881	.080	.059
1973	307,000*	53,140	16,769	?	-	.055
1972	299,000	50,523	16,043	26,480	.088	.054
1971	290,000	49,579	16,356	24,223	.084	.056
1970	286,000	53,026	21,130	27,896	.098	.074
1969	268,000	54,597	21,399	15,198	.057	.080
1968	240,000	54,232	20,157	6,075	.025	.084
1967	209,000	57,520	19,996	6,524	.031	.096
1966	183,000	42,464	14,210	2,254	.012	.078
1965	162,000	33,337	11,043	1,294	.008	.068
1964	139,000	26,425	8,772	?	-	.063

* At the close of 1973, there was a purging of the Airmen Certification files. During this process, approximately 26,000 duplicates or faulty records were eliminated. In order to account for this purging, 16,000 were subtracted from all earlier private pilot totals, 10,000 from commercial, and 26,000 from instrument ratings.

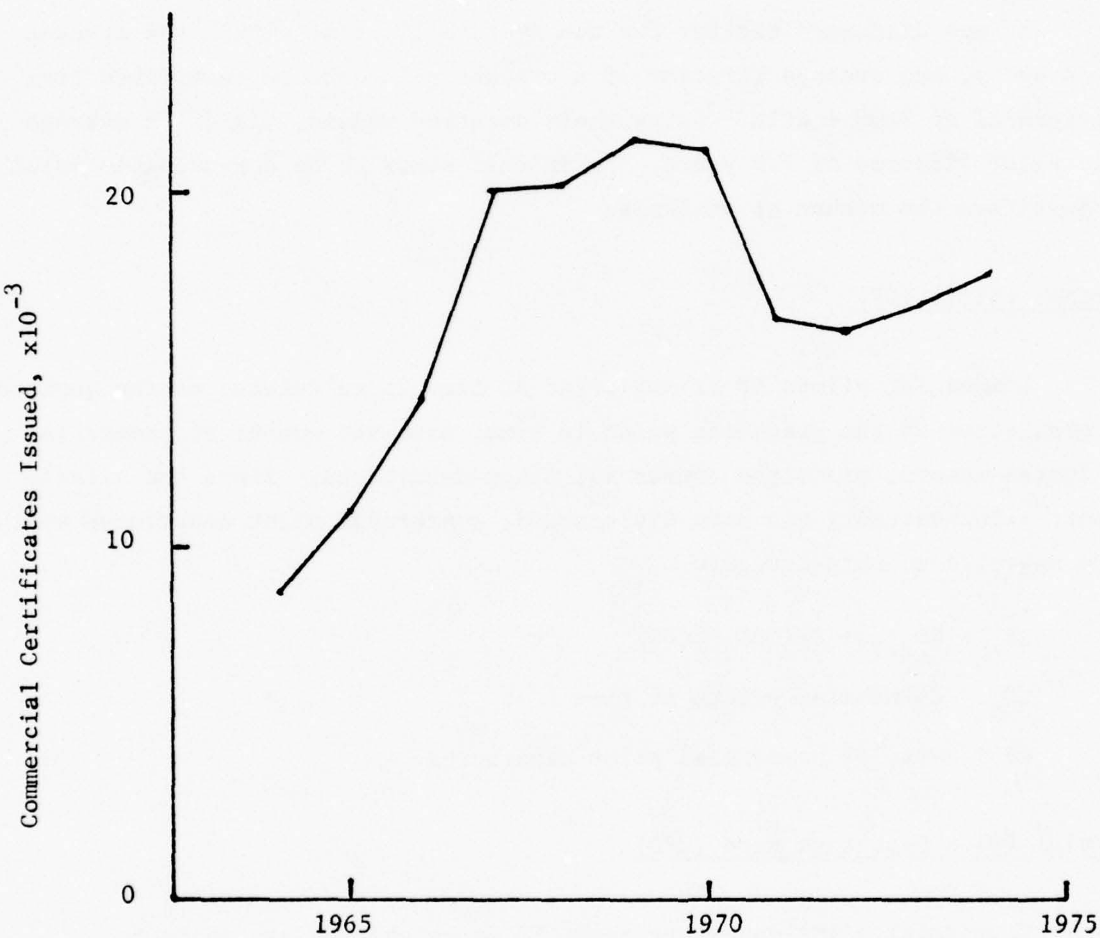

FIGURE 2-9. COMMERCIAL CERTIFICATES ISSUED ANNUALLY

$$CCIN = 0.244 - 0.179 \frac{VC(1)}{VC(1)_{1972}}$$

$$R^2 = 0.47; \; F_{1,7} = 6.28$$

The rate for commercial certificates issued is determined according to

$$CCI = CCIN * PP$$

As was discussed earlier for the average lifetime within the student pilot category, the average lifetime of a private pilot can be determined from the reciprocal of PPDN + CCIN. Using their smoothed values, yields an average private pilot lifetime of 7.9 years. Again this seems to be a reasonable value which justifies the method of analysis.

Commercial Pilots (CP)

Commercial pilots CP at any point in time is calculated as the commercial pilot population at the preceding point in time, plus the number of commercial certificates issued, minus the commercial pilot departures. Since the airline transport pilot category has been disregarded, commercial pilot departures will include upgrades to this category.

$$CP_t = CP_{t-1} + DT(CCI - CPD)$$

CP_t: Commercial pilots at time t

CPD: Rate of commercial pilot departures.

Commercial Pilot Departure Rate (CPD)

Commercial pilot departure rate CPD is calculated according to

$$CPD = CPDN * CP \; .$$

Annual values for CPDN are given in Table 2-10; the exponentially smoothed value for CPDN is .048. The reciprocal of CPDN indicates an average commercial pilot lifetime of 20.8 years.

TABLE 2-10. COMMERCIAL PILOT DEPARTURE RATE NORMAL

	Commercial Certificates As of Jan. 1	Commercial Certificates Issued During	Commercial Pilot Departures During	CPDN
1975	192,425			
1974	182,444	17,693	7,712	.042
1973	183,000*	16,769	?	-
1972	182,000	16,043	12,043	.066
1971	177,000	16,356	11,356	.064
1970	167,000	21,130	11,130	.067
1969	154,000	21,399	8,399	.055
1968	140,000	20,157	6,157	.044
1967	122,000	19,996	1,996	.016
1966	107,000	14,210	?	-
1965	98,000	11,043	2,043	
1964	86,000	8,772	?	-

* At the close of 1973, there was a purging of the Airmen Certification files. During this process, approximately 26,000 duplicates or faulty records were eliminated. In order to account for this purging, 16,000 were subtracted from all earlier private pilot totals, 10,000 from commercial, and 26,000 from instrument ratings.

Instrument-Rated Pilots (IP)

The assumption being made is that all new commercial certificates will also have an instrument rating. Therefore, the number of instrument-rated pilots IP at any point in time is calculated as the instrument-rated pilot population at the preceding point in time, plus the number of private pilots obtaining an instrument rating during the intervening interval, plus the number of commercial certificates issued, minus the instrument-rated pilot departures.

$$IP_t = IP_{t-1} + DT(URIP + CCI - IPD)$$

IP_t: Instrument-rated pilots at time t

URIP: Upgrade rate to instrument from private

IPD: Instrument-rated pilot departure rate.

Instrument-Rated Pilot Departure Rate (IPD)

Annual values for the instrument-rated pilot departure rate normal IPDN are given in Table 2-11. Recalling that the airmen files were purged at the close of 1973, it is impossible to determine a valid data point for that year. FAA published figures for instrument-ratings held previous to January 1, 1974, were (somewhat) arbitrarily decreased by the 26,000 faulty records found during the file purge. In determining an annual value for IPDN, the difference in ratings held between successive years is more important than the actual number outstanding on a particular date. A smoothed value of IPDN through 1974 is .037 which implies an average instrument rating lifetime of 27.0 years. Instrument-rated pilot departure rate is

$$IPD = IPDN*IP$$

TABLE 2-11. INSTRUMENT-RATED PILOT DEPARTURE RATE NORMAL

	Instrument Ratings Held as of Jan. 1	Instrument Ratings Issued During	Instrument Rating Departures During	IPDN
1975	199,323			
1974	185,969	19,012	5,385	.029
1973	162,000*	19,590	?	-
1972	153,000	17,311	8,311	.054
1971	144,000	17,207	8,207	.057
1970	130,000	20,204	6,204	.048
1969	113,000	20,628	3,628	.032
1968	97,000	17,972	1,972	.020
1967	81,000	19,255	3,255	.040
1966	68,000	14,192	1,192	.018

* At the close of 1973, there was a purging of the Airmen Certification files. During this process, approximately 26,000 duplicates or faulty records were eliminated. In order to account for this purging, 16,000 were subtracted from all earlier private pilot totals, 10,000 from commercial, and 26,000 from instrument ratings.

Upgrade Rate to Instrument from Private (URIP)

The rate at which private pilots are obtaining instrument-ratings is calculated by

$$URIP = URIPN * PP.$$

The annual values of URIPN in Table 2-12 yield a smoothed value of .014.

Helicopter Certificates Issued (HCI)

Figure 2-10 is a plot of the helicopter certificates issued during each year since 1964. As with student certificates, the mid-60s experienced a tremendous growth in the number of helicopter certificates issued annually. In the early 70s, the number of certificates issued has steadily decreased. In order to get some idea of the cost impact on certificates issued, the four most recent data points were assumed to be varying strictly because of the variable cost of operating piston helicopters. A log linear regression analysis yielded,

$$HCI = 2650 * \left(\frac{VC(6)}{VC(6)_{1972}} \right)^{-5.33}$$

$$R^2 = .82$$

$$F_{1,2} = 9.4$$

Helicopter Pilots (HP)

Helicopter pilots HP at any point in time are calculated as the helicopter pilot population at the preceding point in time, plus the number of helicopter certificates issued, minus the helicopter pilot departures.

$$HP_t = HP_{t-1} + DT(HCI - HPD)$$

HP_t: helicopter pilots at time t

HPD: Rate of helicopter pilot departures

TABLE 2-12. NORMAL UPGRADE RATE TO INSTRUMENT-RATING FOR PRIVATE PILOTS

	Private Certificates As of Jan. 1	Instrument Rating Certificates Issued To Privates During	URIPN
1975	305,848		
1974	298,921	4,829	.0162
1973	307,000	4,587	.0149
1972	299,000	3,853	.0129
1971	290,000	3,625	.0118
1970	286,000	3,790	.0126
1969	268,000	3,556	.0125
1968	240,000	2,948	.0123

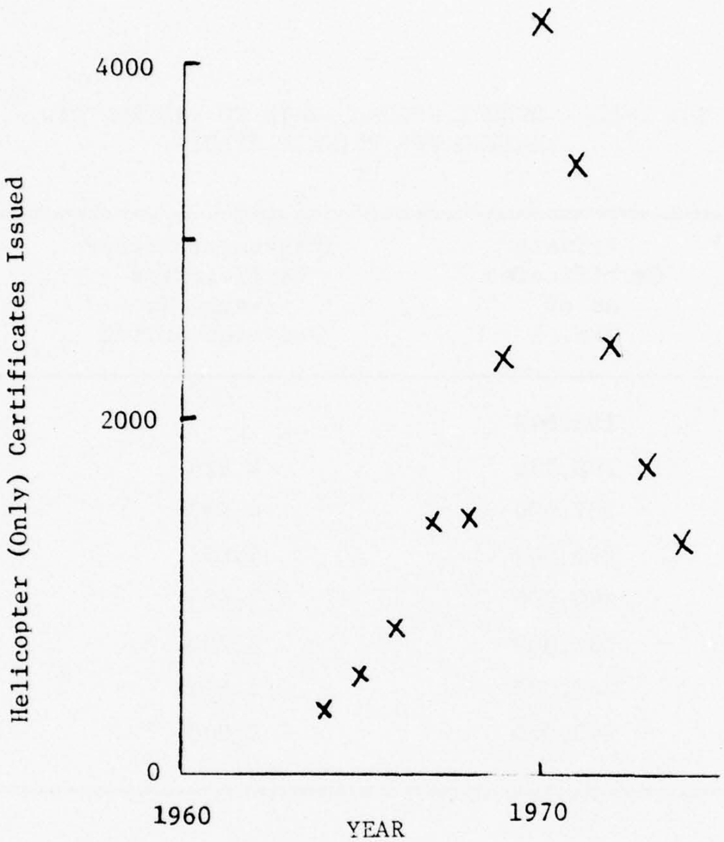

FIGURE 2-10. HELICOPTER CERTIFICATES ISSUED

Helicopter Pilot Departure Rate (HPD)

Helicopter pilot departure rate HPD is calculated according to

HPD = HPDN*HP

Annual values for HPDN are given in Table 2-13; the exponentially smoothed average value for CPDN = 0.285. The reciprocal of CPDN indicates an average helicopter pilot lifetime of 3.6 years. This seems low, but many helicopter pilots eventually obtain an airplane certificate which represents a departure from this category.

Helicopter-Rated Pilots (HR)

Helicopter-rated pilots are those pilots holding a fixed wing airman certificate with an additional rating for flying helicopters. Therefore, the number of helicopter-rated pilots HR at any point in time is calculated as the helicopter-rated pilot population at the preceeding point in time, plus the number of new helicopter ratings issued, minus the helicopter-rated pilot departures.

$$HR_t = HR_{t-1} + DT(HRI-HRD)$$

HR_t: Helicopter-rated pilots at time t

HRI: Helicopter-ratings issued rate

HRD: Helicopter-ratings departure rate

Helicopter-Rated Pilot Departure Rate (HRD)

Table 2-14 indicates that commercial certificated pilots hold approximately ten times as many helicopter ratings as either private pilots or others. The assumption was made that the fractional rate of departure for helicopter rated pilots HRDN will equal the fractional rate of departure for commercial pilots CPDN,

HRD = HRDN* HR

where HRDN = 0.048/year.

TABLE 2-13. HELICOPTER PILOT DEPARTURE RATE NORMAL

	Helicopter Certificates As Of Jan. 1	Helicopter Certificates Issued During	Helicopter Pilot Departures During	HPDN
1975	5647			
1974	5968	1298	1619	.271
1973	(7987)*	1719	(3738)	(.468)
1972	7992	2421	2426	.304
1971	6677	3448	2133	.319
1970	4286	4250	1859	.434
1969	3166	2326	1206	.381
1968	2573	1433	840	.326
1967	1819	1411	657	.361
1966	1392	822	395	.284
1965	1058	549	215	.203
1964	823	344	109	.132

* At the close of 1973, there was a purging of the Airmen Certification files. During this process, approximately 26,000 duplicates or faulty records were eliminated. In order to account for this purging, 16,000 were subtracted from all earlier private pilot totals, 10,000 from commercial, and 26,000 from instrument ratings.

TABLE 2-14. HELICOPTER RATINGS

	Commercial Airplane, Commercial Helicopter	Private Airplane, Private Helicopter	Other Helicopter Ratings
1975	19,247	1948	1776
1974*	(18,335)	(1944)	(1515)
1973	19,507	2079	1568
1972	18,326	1839	1428
1971	16,422	1441	1382
1970	14,374	997	1239

* At the close of 1973, there was a purging of the Airmen Certification files. During this process, approximately 26,000 duplicates or faulty records were eliminated. In order to account for this purging, 16,000 were subtracted from all earlier private pilot totals, 10,000 from commercial, and 26,000 from instrument ratings.

Helicopter-Ratings Issued (HRI)

Since commercial certificated pilots are the predominant holders of additonal helicopter ratings, the rate of issuance of additional helicopter ratings is assumed to be directly proportional to the number of active commercial pilots. Table 2-15 presents the data used in deriving the fractional helicopter-ratings-issued-normal HRIN. Note that the helicopter rating departures recorded in Table 2-15 are values derived from the above expression for HRD.

$$HRI = HRIN * CP$$

The value of HRIN appears to be steadily decreasing during the time interval of valid data. Rather than exponentially smooth a constantly decreasing value, the most recent derived value was chosen; that is, HRIN = .012/year.

TABLE 2-15. HELICOPTER RATINGS ISSUED NORMAL

	Additional Helicopter Ratings As Of Jan. 1	(Derived) Helicopter Rating Departures During	Helicopter Ratings Issued During	Commercial Certificates As Of Jan. 1	HRIN
1975	22,971			192,425	
1974	21,794	1,046	2223	182,444	.012
1973	23,154	--	--	183,000	--
1972	21,593	1,036	2597	182,000	.014
1971	19,245	924	3272	177,000	.018
1970	16,610	797	3432	167,000	.021

CHAPTER 4. THE AIRCRAFT UTILIZATION AND DEMAND SECTORS

A basic hypothesis implemented in the model is that each subsegment of general aviation is striving to achieve its goal for the number of active aircraft. This goal, DAA, the desired-active-aircraft, can be a complex function of the number of pilots, the average aircraft utilization rate last year, fixed costs, variable costs, and exogenous inputs for GNP, DPI or MI. Thus, the dynamics within the general aviation system are the result of continuous causal interactions between the pilot supply sector, the aircraft utilization sector, and the aircraft demand sector. Because the interdependence between the aircraft utilization and demand sectors is so strong, they will be discussed simultaneously for each user category.

Figure 2-11 illustrates a portion of the structure that is common to all user categories. The number of active aircraft within any user category/aircraft type subsegment $AA_{i,j}$ is determined by the aircraft destruction rate $ADR_{i,j}$ and the aircraft activation rate $AAR_{i,j}$. Although $ADR_{i,j}$ strictly reduces the number of active aircraft, $AAR_{i,j}$ can be either positive or negative. In mathematical form

$$AA(I,J)_t = AA(I,J)_{t-1} + DT(AAR(I,J) - ADR(I,J))$$

$AA(I,J)_t$: Active aircraft at time t (aircraft)

AAR: Aircraft activation rate (aircraft/year)

ADR: Aircraft destruction rate (aircraft/year)

The aircraft destruction rate is a function of the annual number of hours flown. According to "Safety in General Aviation", the destruction rate per 1000 flight hours is dependent on user category only; that is, it is independent of aircraft type. The normal values for aircraft destruction rate ADRN are given in Table 2-16. With these values ADR is determined from

$$ADR(I,J) = ADRN(I)*HF(I,J)$$

ADRN: Aircraft destruction rate normal (aircraft/year/hours flown)

HF: Annual hours flown (hours flown)

The aircraft activation rate represents the combined effect of purchases of new or used aircraft, aircraft deactivation and aircraft transfers to different user categories. The assumption is made that there is an adequate inventory of new and used aircraft to satisfy all demands. The goal of this system is to maintain the number of active aircraft at the level of desired-active-aircraft DAA. If DAA is greater than AA, then more aircraft will be activated; if, on the other

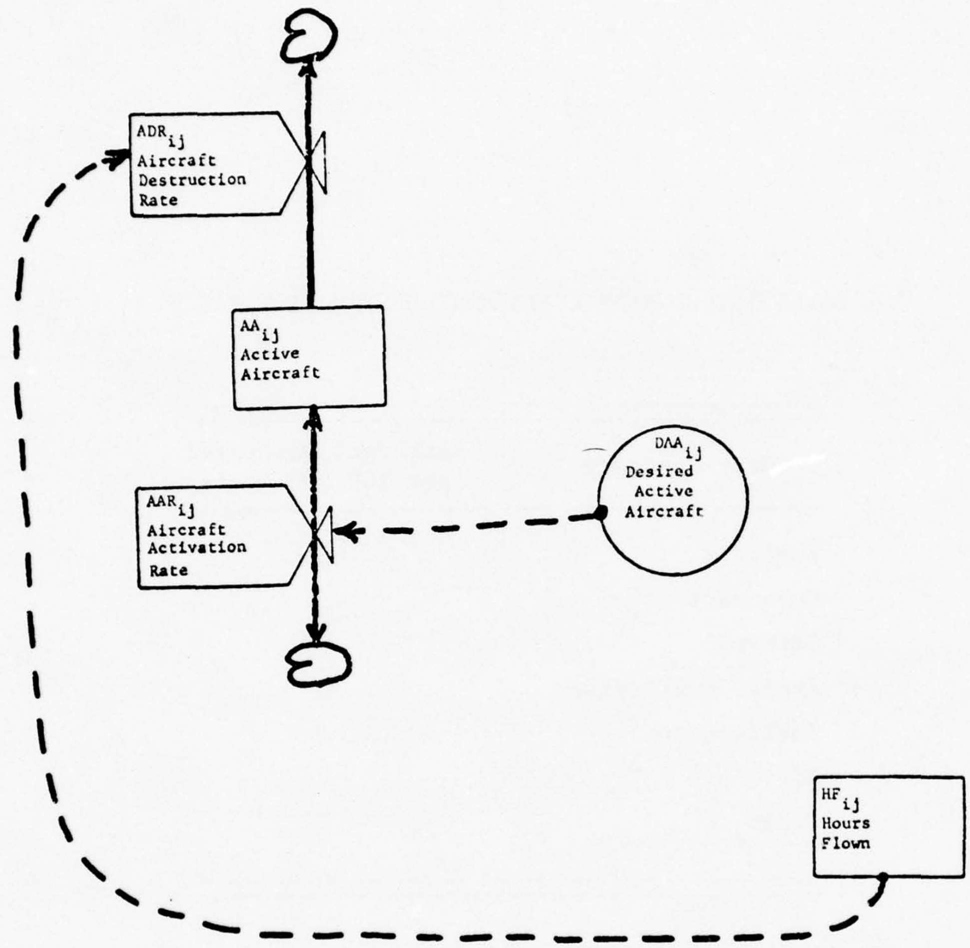

FIGURE 2-11. AIRCRAFT DEMAND SECTOR

TABLE 2-16. NORMAL AIRCRAFT DESTRUCTION RATES

User Category	Aircraft Destroyed per 100,000 hours
Business	3
Corporate	3
Personal	7
Aerial Application	6
Instructional	3
Air Taxi	2
Other	7

hand, DAA is less than AA, there will be a net flow of aircraft out of this particular subsegment. Of course, these adjustments to the active aircraft fleet cannot occur instantaneously. In particular, for each subsegment there will be an average delay time AT(I,J) in actually realizing these adjustments. Functionally,

AAR(I,J) = (DAA(I,J) - AA(I,J))/AT(I,J)

DAA: Desired-active-aircraft (aircraft)

AT: Adjustment time (years)

Primary Use - Business

Figure 2-12 shows the fundamental mechanisms that control activity within the "business" use category. The main contention here is that an aircraft used primarily for business will be owned and operated by the same individual. Since this individual must be a member of the active pilot population, there should exist a parameter for describing the propensity for pilots to demand business aircraft. DPPA, desired-pilots-per-aircraft, relates the demand for business aircraft to the number of active pilots (private and commercial).

The goal for active aircraft DAA is simply

DAA(I,J) = TP/DPPA(I,J)

where TP is total pilots and is equal to the sum of private plus commercial pilots when J identifies fixed wing aircraft, but is equal to the number of helicopter ratings outstanding when J signifies helicopters.

From the data presented in Volume IV, aircraft activations for the business/single-engine piston subsegment can be constructed as in Table 2-17. The key parameter to be determined here is the aircraft activation rate AAR. This represents the decision policy followed by this particular subsegment of the system. Figure 2-13 shows a plot of AAR(1,1) during the four years for which data are available. With only four data points, ordinary least squares analyses would seem to be inappropriate. However, recalling the functional definition for aircraft activation rate

AAR(I,J) = (DAA(I,J) - AA(I,J))/AT(I,J) (1)

and substituting the expression for DAA, yields for the business/single-engine piston subsegment

$$AAR(1,1) = \left\{\frac{TP}{DPPA(1,1)} - AA(1,1)\right\} / \; AT(1,1)$$

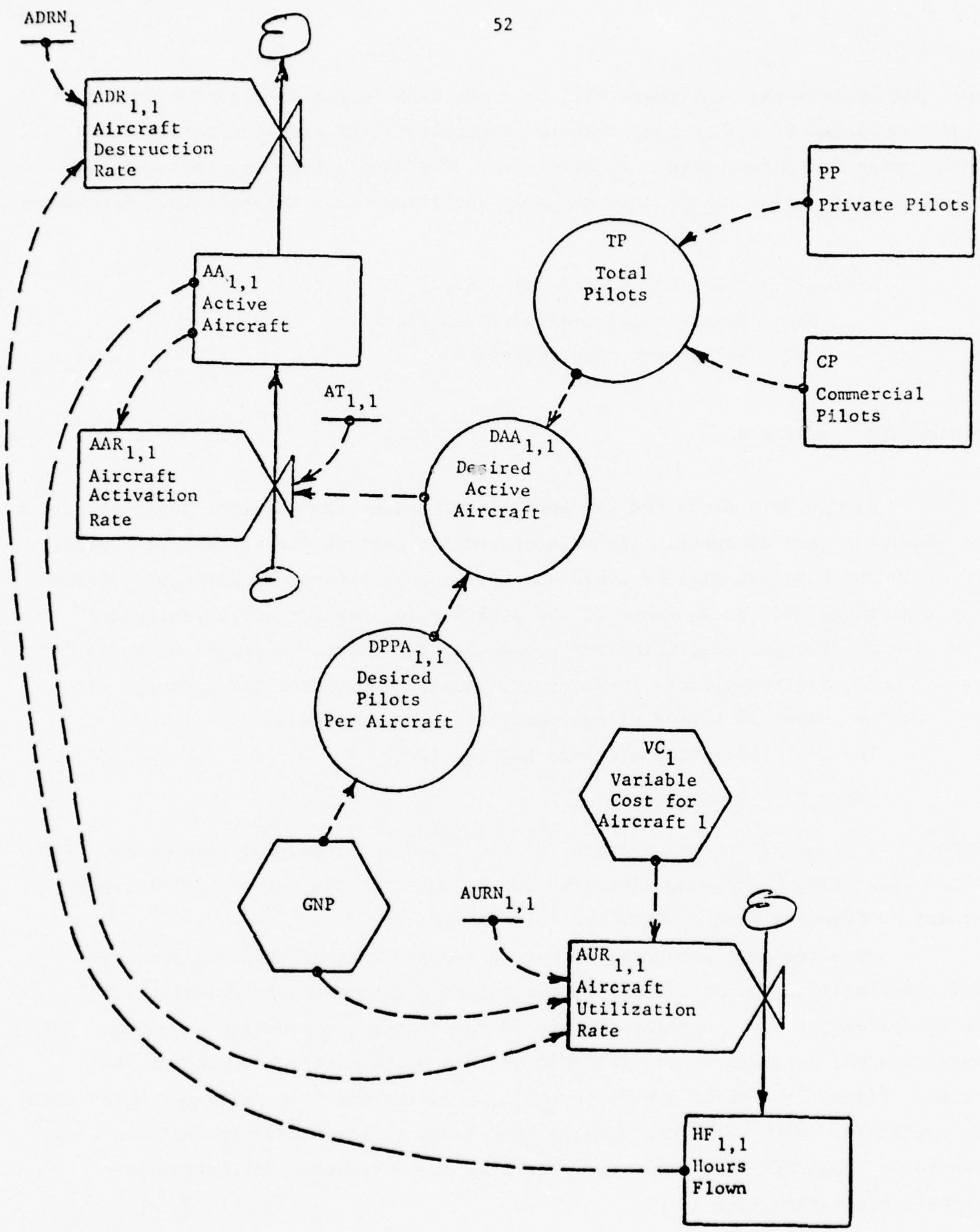

FIGURE 2-12. BUSINESS/SINGLE-ENGINE PISTON EXAMPLE

TABLE 2-17. ESTIMATED DESIRED-PILOTS-PER-AIRCRAFT IN THE BUSINESS/SINGLE ENGINE PISTON SUBSEGMENT

Year	AA(1,1) as of Jan 1	Estimated ADR(1,1) during	Estimated AAR(1,1) during	TP= PP+CP Jan 1	Estimated DPPA during
1971	20,522	94	-344	467,000	23.54
1972	20,084	93	1549	481,000	20.75
1973	21,540	114	3943	490,000	16.65
1974	25,369	125	768	481,365	17.89
1975	26,012			498,273	

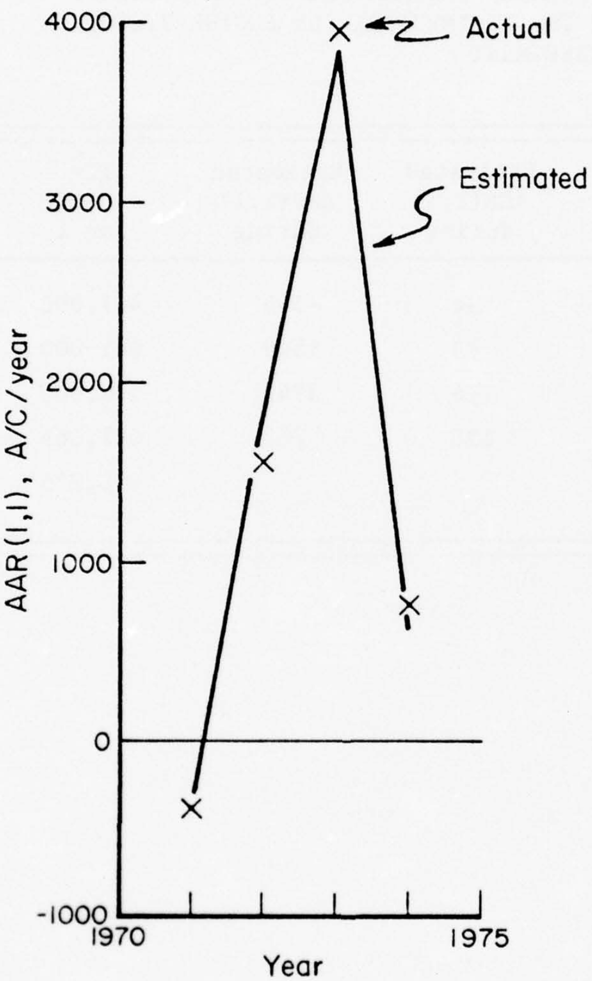

FIGURE 2-13. AIRCRAFT ACTIVATIONS IN THE BUSINESS/SINGLE-ENGINE PISTON SUBSEGMENT

Solving for DPPA,

$$DPPA(1,1) = TP/(AT(1,1)*AAR(1,1) + AA(1,1)) \tag{2}$$

The only unknown on the right hand side of this equation is AT(1,1), the average delay time in adjusting for a discrepancy between the desired number of aircraft and the actual active aircraft. Because of the discrete nature of data reporting on an annual basis, AT can be assumed to be an integer value; the ultimate choice being dictated by the best fit of the data.

DPPA is not likely to be a constant but should be reflective of general economic conditions as well as the relative cost of aircraft ownership. At an adjustment time of 2 years, the desired-pilot-per-aircraft values calculated from Equation (2) are:

YEAR	DPPA(1,1)
1971	23.5
1972	20.8
1973	16.7
1974	17.9

The fixed cost of ownership turned out to be statistically insignificant in explaining the variation in DPPA. However, a high correlation was found with GNP. Figure 2-14 indicates the variation of DPPA(1,1) with percentage changes in GNP measured in constant 1972 dollars and indexed to the 1972 value of GNP. Unfortunately, the data in Figure 2-14 only encompasses a range in GNP from .94 to 1.05. Realizing that ultimate use of the model will extrapolate GNP far past the limits experienced, it is extremely important to input functional forms that will not lead to ridiculous conclusions. In particular, if a strictly linear function were used for the dependence of DPPA on GNP, DPPA would quickly decrease as GNP increased. Eventually, every active pilot would desire a business aircraft. Because of this, an exponential relationship was used to fit the data. The resulting expressions do not show as great a sensitivity to increases in GNP past the presently available data. Results for fixed wing aircraft are:

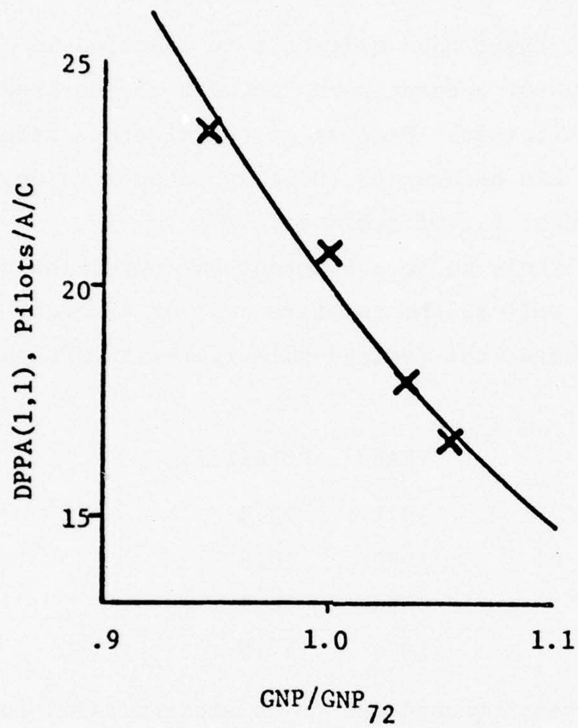

FIGURE 2-14. DESIRED-PILOTS-PER-AIRCRAFT AS A FUNCTION OF GNP

$$DPPA(1,1) = 20.0\ GNP^{-3.23}$$
$$AT(1,1) = 2.\quad \text{(years)}$$
$$R^2 = .97$$
$$F_{1,2} = 72$$

$$DPPA(1,3) = 62.6\ GNP^{-2.92}$$
$$AT(1,3) = 3.\quad \text{(years)}$$
$$R^2 = .98$$
$$F_{1,2} = 79$$

The desired-pilot-per-aircraft parameter for helicopters within the business category did turn out to be a function of the total cost of operation TC,

$$DPPA(1,6) = 88.4 \left(\frac{GNP}{TC(1,6)}\right)^{-1.47}$$
$$AT(1,6) = 1.\quad \text{(year)}$$
$$R^2 = .59$$
$$F_{1,2} = 2.9$$

Figure 2-12 indicates that the annual aircraft utilization rate within the business category is a function of the normal aircraft utilization rate AURN, the GNP, and the variable cost of operation VC. Although the mechanisms behind the demand for business and corporate aircraft are different, operation of active aircraft within these two categories is likely to be dependent on the same parameters. So in order to obtain a statistically larger base to work from, the single-engine and multi-engine piston aircraft from both business and corporate were pooled together. However, in order to preserve the idea of an average annual utilization rate for each user category/aircraft type subsegment, the dependent variable regressed was ratioed from the 1972 value of AUR(I,J).

Results of the pooled regression were

$$AUR(I,J) = AURN(I,J)*GNP^{-.511} * VC(J)^{-.308}$$

AURN(1,1) = 151	(hours/aircraft/year)			
AURN(1,3) = 203	"	"	"	
AURN(2,1) = 212	"	"	"	
AURN(2,3) = 368	"	"	"	

$$R^2 = .13$$
$$F_{2,17} = 1.3$$

The low R^2 indicates only a small portion of the variance is explained by the independent variables. Indeed, perhaps the only reason for including these terms in the model is that the sign of the exponent on VC(J) appears to be correct; that is, as variable costs increase, annual utilization rates should decrease. On the other hand, one would expect a priori that as GNP decreased, annual utilization rates would also decrease. The sign of the exponent on GNP indicates just the opposite. Some reflection on the aircraft demand sector may explain this apparent incongruity. Demand for business aircraft has been shown to be positively correlated with GNP. Demand for corporate aircraft will also be shown to be positively correlated with GNP. Thus, a decrease in GNP will cause a net reduction in both the business and corporate fleets. Assuming that reductions will be satisfied by the marginal users, then it could be expected that the average annual utilization of those aircraft remaining will actually be greater than before.

A similar analysis was applied to the pooled helicopter subsegments of business and corporate categories.

$$AUR(I,J) = AURN(I,J)*GNP^{-1.448}*VC(J)^{-.806}$$

$$AURN(1,6) = 239 \quad \text{(hours/aircraft/year)}$$

$$AURN(2,7) = 425 \quad \text{" \quad " \quad "}$$

$$R^2 = .57$$

$$F_{2,7} = 4.7$$

Primary Use - Corporate

Figure 2-15 shows the fundamental mechanisms that generate activity within the "corporate" use category. It is similar to the flow diagram for the business category, except that the desired-active-aircraft DAA is a function of GNP directly. There is no intervening parameter such as desired-pilot-per-aircraft. The reasoning here is that the number of corporate aircraft is neither restricted nor enhanced by the number of available pilots. Should a corporation obtain an aircraft, it is a relatively easy matter to hire the pilots required to fly it.

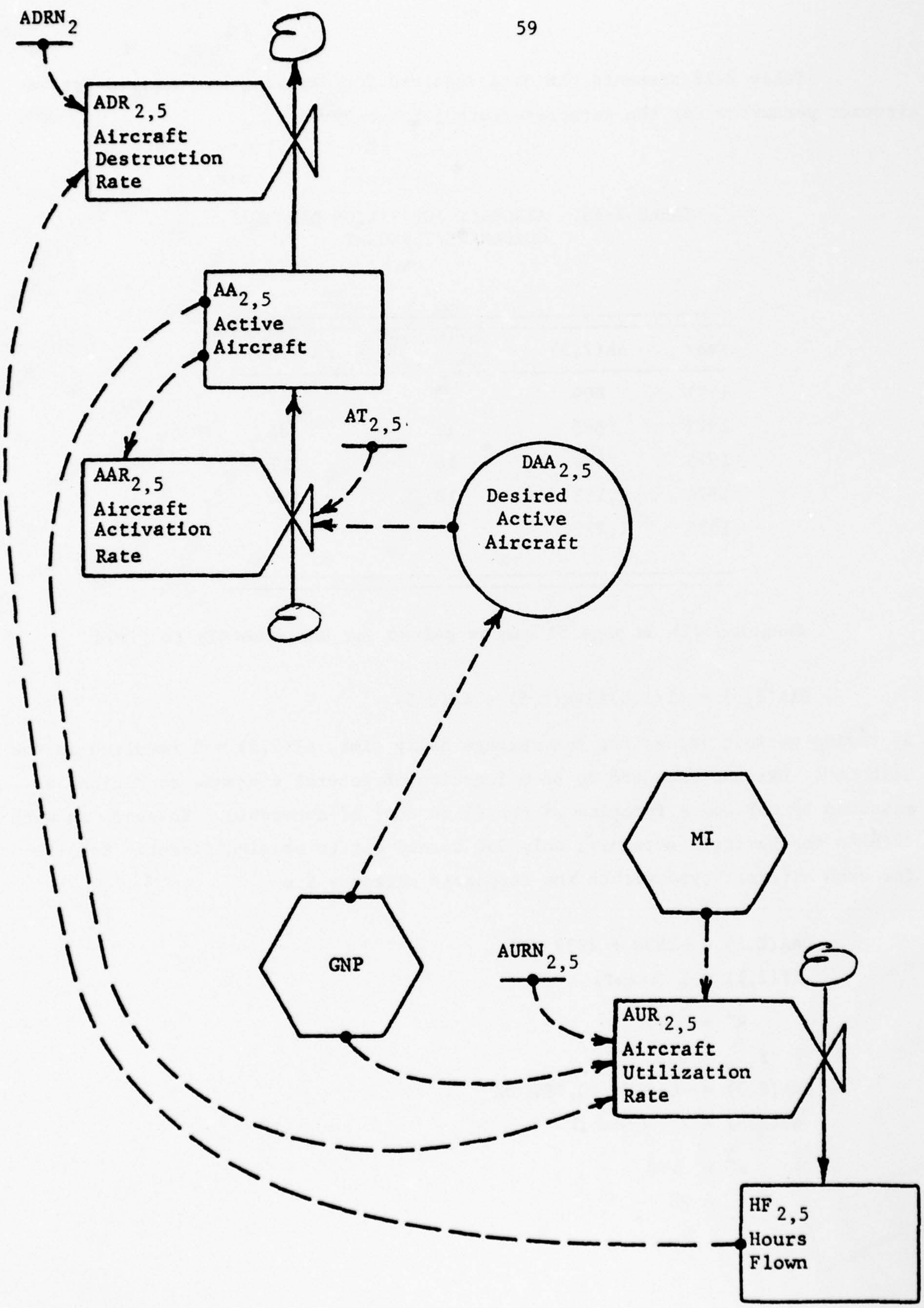

FIGURE 2-15. CORPORATE/TURBOJET EXAMPLE

Table 2-18 presents the data required for deriving the desired-active-aircraft parameter for the corporate/turbojet subsegment.

TABLE 2-18. AIRCRAFT ACTIVATION DATA FOR CORPORATE/TURBOJET

Year	AA(2,5)	Estimated ADR(2,5)	AAR(2,5)
1971	809	13	67
1972	863	14	85
1973	934	18	217
1974	1,133	18	164
1975	1,279		

Equation (1) on page 51 can be solved for DAA directly to yield

$$DAA(2,5) = AT(2,5)*AAR(2,5) + AA(2,5)$$

By trying various values for the average delay time, AT(2,5) = 3 resulted in the best fit. DAA was expected to be a function of general economic conditions as measured by GNP and a function of the fixed cost of ownership. However, as with DPPA in the business category, only GNP turned out to be significant. Results for each aircraft type within the corporate category are

$$DAA(2,1) = -1830 + 2937\ GNP$$
$$AT(2,1) = 1 \quad \text{(year)}$$
$$R^2 = .77$$
$$F_{1,2} = 6.8$$
$$DAA(2,3) = -6698 + 10{,}784\ GNP$$
$$AT(2,3) = 2 \quad \text{(years)}$$
$$R^2 = .98$$
$$F_{1,2} = 78$$

$$DAA(2,4) = -2252 + 3594\ GNP$$
$$AT(2,4) = 1 \quad \text{(year)}$$
$$R^2 = .55$$
$$F_{1,2} = 2.5$$

$$DAA(2,5) = -4842 + 6127\ GNP$$
$$AT(2,5) = 3 \quad \text{(years)}$$
$$R^2 = .83$$
$$F_{1,2} = 10.1$$

$$DAA(2,7) = -566 + 826\ GNP$$
$$AT(2,7) = 1 \quad \text{(year)}$$
$$R^2 = .53$$
$$F_{1,2} = 2.2$$

The strictly linear functional form was used to prevent DAA from rising too rapidly as GNP increases from the present value. Note that if economic growth should be curtailed such that GNP (measured in constant dollars) remained constant, the goal for active corporate aircraft would remain constant. Eventually the aircraft activation rate would equal replacement of destroyed aircraft only.

Results for the analysis of aircraft utilization rates for single-engine piston, multi-engine piston and turbine helicopters were presented with the pooled models in the business use category. Corporate turboprops and turbojets were also pooled and analyzed similarly. The most significant results were

$$AUR(I,J) = AURN(I,J)*MI^{1.76}$$
$$AURN(2,4) = 496 \quad \text{(hours/aircraft/year)}$$
$$AURN(2,5) = 496 \quad \text{"} \quad \text{"} \quad \text{"}$$
$$R^2 = .57$$
$$F_{1,8} = 10.6$$

The only independent parameter that was significant is the level of service indicator for commercial air traffic, MI. This parameter is measured in revenue-aircraft-departures and normalized to the 1972 value. Initially, it was thought that this parameter would indicate the substitutability between competing modes. However, the positive exponent on MI indicates that as revenue aircraft departures decreased recently, the average utilization of corporate turboprops and turbojets also decreased. Thus, instead of there being a competitive nature between corporate and commerical flying, it appears that the forces which would cause a decrease in commercial traffic are acting similarly on corporate flying; viz. the pressure to reduce flights during the fuel crisis, or the environmental pressures to reduce night flights, etc.

Primary Use - Personal

The fundamental mechanisms generating activity within the "personal" use category are shown in the flow diagram of Figure 2-16. As in the business category, a personal use aircraft is generally owned and operated by the same individual. This suggests investigation of another desired-pilot-per-aircraft parameter. The goal for active aircraft is

$$DAA(I,J) = TP/DPPA(I,J)$$

Within the personal use category, DPPA is a function of DPI rather than GNP. In the case of multi-engine piston aircraft, total annual cost of operation was also found to be significant; because of the scarcity of data, it was necessary to force DPI and TC into the equation as a ratio. Results of log-linear regression analyses are

$$DPPA(3,1) = 6.86\ DPI^{-.518}$$

$$AT(3,1) = 1 \text{ (year)}$$

$$R^2 = .23$$

$$F_{1,2} = .6$$

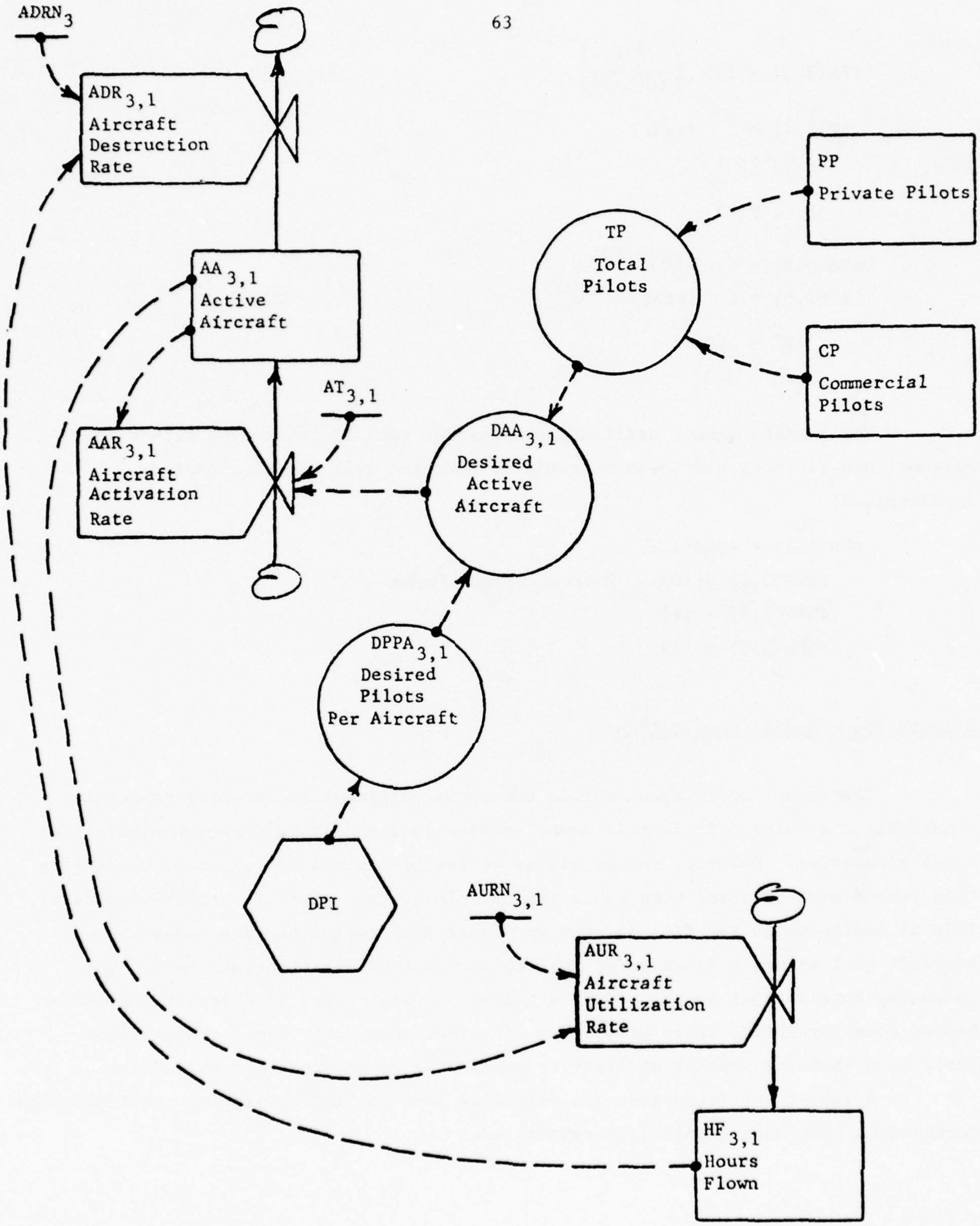

FIGURE 2-16. PERSONAL/SINGLE-ENGINE PISTON EXAMPLE

$$DPPA(3,3) = 175 \left(\frac{DPI}{TC(3,3)}\right)^{-.923}$$

$$AT(3,3) = 1 \quad \text{(year)}$$

$$R^2 = .25$$

$$F_{1,2} = .7$$

$$DPPA(3,6) = 89.5 \; DPI^{-.701}$$

$$AT(3,6) = 1 \quad \text{(year)}$$

$$R^2 = .62$$

$$F_{1,2} = 3.3$$

The average annual utilization rates for each aircraft type within the personal use category have been essentially constant over the time period investigated,

AUR(I,J) = AURN(I,J)

AURN(3,1) =	104	(hours/aircraft/year)
AURN(3,3) =	141	" " "
AURN(3,6) =	29	" " "

Primary Use - Aerial Application

The annual hours flown within the aerial application category represents demand for a service. It is this annual demand that should be forecast within the model simulation. However, the provision of aerial-application aircraft to satisfy this demand will be based upon achieving certain desired aircraft utilization rates. This is indicated in the flow diagram of Figure 2-17, where the desired-active-aircraft goal is now a function of desired-aircraft-utilization-rate DAUR. The reasoning here is that as the actual utilization rate of aerial aircraft increases beyond some threshold, there will be an increased demand for these types of aircraft such that the average utilization rates will be reduced to a normal value.

A variety of regression analyses were made on DAUR by varying the independent parameters. The most significant results are:

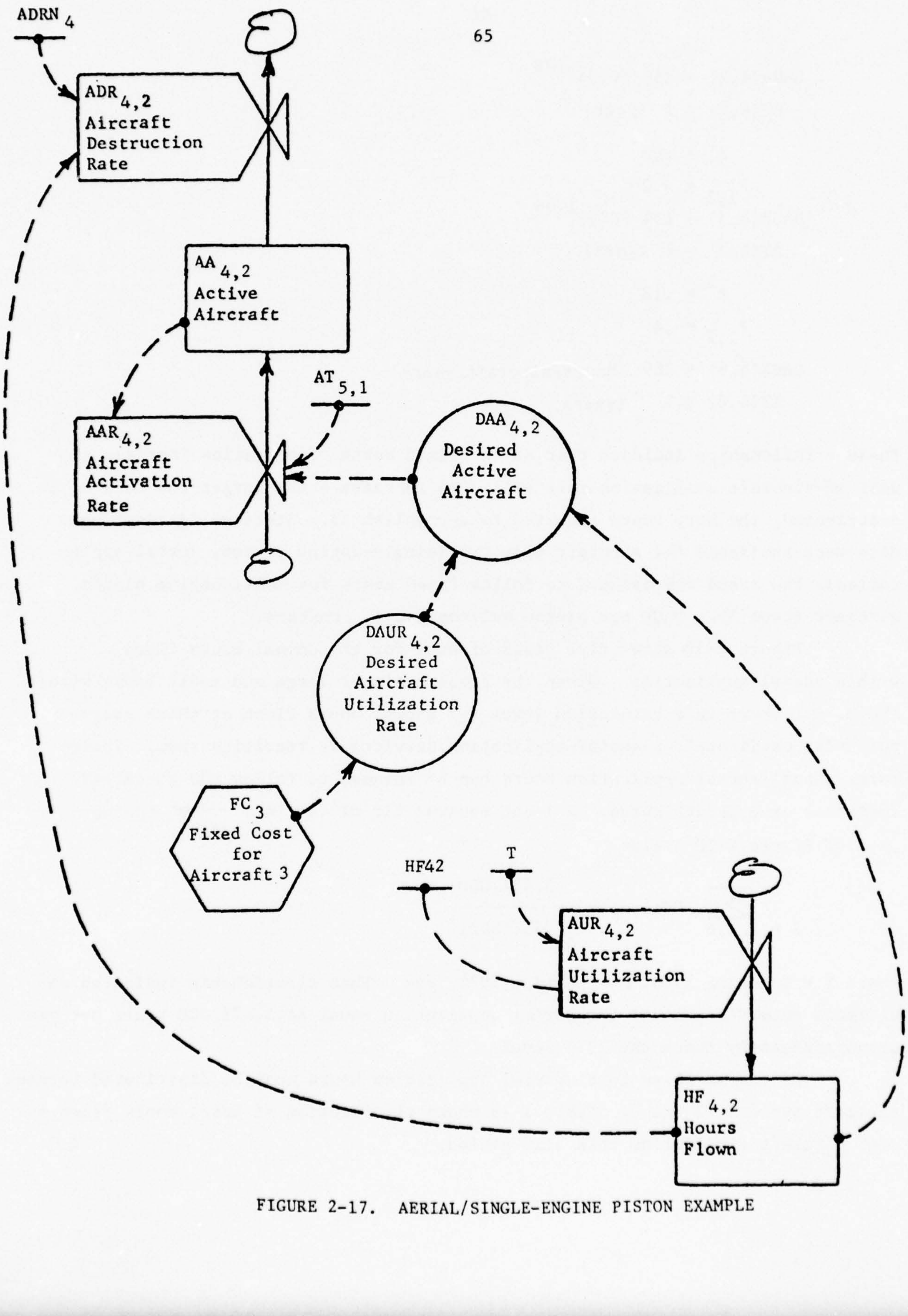

FIGURE 2-17. AERIAL/SINGLE-ENGINE PISTON EXAMPLE

$$\mathrm{DAUR}(4,2) = 236\ \mathrm{FC}(3)^{.978}$$
$$\mathrm{AT}(4,2) = 1\ \text{(year)}$$
$$R^2 = .68$$
$$F_{1,2} = 4.2$$
$$\mathrm{DAUR}(4,3) = 134\ \mathrm{FC}(3)^{1.86}$$
$$\mathrm{AT}(4,3) = 1\ \text{(year)}$$
$$R^2 = .18$$
$$F_{1,2} = .4$$
$$\mathrm{DAUR}(4,6) = 289\ \text{(hours/aircraft/year)}$$
$$\mathrm{AT}(4,6) = 1\ \text{(year)}$$

These relationships indicate that as the fixed costs of operation increase the desired-aircraft-utilization-rate will also increase - the larger the cost to be distributed, the more hours required to accomplish it. Since no distinct cost data were available for aircraft type two (single-engine piston, aerial application), the trend was assumed to follow fixed costs for multi-engine piston aircraft (type 3). DAUR for piston helicopters is constant.

Figure 2-18 shows five years of data for the annual hours flown within aerial application. Given the present mix of large and small farms within the U. S., there is a saturation level for annual hours flown at which every potential candidate for aerial application services is receiving them. Therefore, annual aerial application hours can be assumed to follow the so-called logistics or S-growth curve. A least squares fit of the form $\frac{S}{e^{a*b^T}}$, to the data of Figure 2-18 yields

$$\sum_{J = 2,3,6} \mathrm{HF}(4,J) = \frac{3,451,000}{e^{.955(.882)^T}}$$

where T = 0 during 1970, T = 1; during 1971, etc. This relationship indicates an ultimate saturation level for aerial application equal to 3,451,000 hours per year, or approximately twice the 1974 level.

Of course these total aerial application hours must be distributed between aircraft types 2, 3 and 6. Table 2-19 shows the fraction of total hours flown by each aircraft type during this time period.

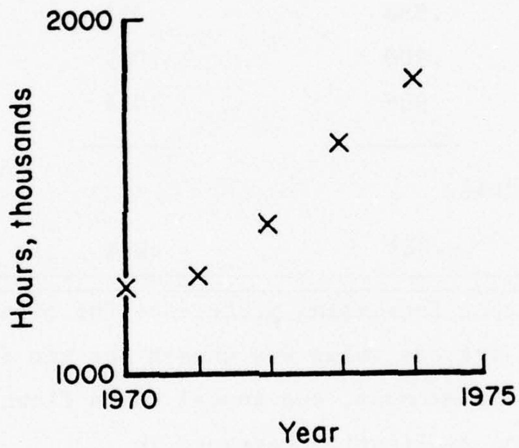

FIGURE 2-18. ANNUAL HOURS FLOWN IN AERIAL APPLICATION

TABLE 2-19. FRACTION OF TOTAL AERIAL APPLICATION HOURS FLOWN BY EACH AIRCRAFT TYPE

Year	Single-Engine Piston, Aerial Application	Multi-Engine Piston	Piston Helicopter
1970	.897	.022	.081
1971	.907	.021	.071
1972	.888	.025	.087
1973	.900	.029	.071
1974	.938	.012	.050
Exponentially Smoothed Average	.911	.021	.068

Since there is no apparent increasing preference for either aircraft types, an exponentially smoothed average value was chosen for the fraction to be applied to future forecasts. For example, the annual hours flown by multi-engine piston within the aerial application category is

$$HF(4,3) = .021 * \sum_{J=2,3,6} HF(4,J)$$

Since the annual hours flown are forecast directly, the desired-active-aircraft can be found from

$$DAA(I,J) = HF(I,J)/DAUR(I,J)$$

The aircraft activation rate, as always, is then

$$AAR(I,J) = (DAA(I,J) - AA(I,J))/AT(I,J)$$

Primary Use - Instructional

The level of instructional flying should be directly related to the number of new certificates and ratings issued. Figure 2-19 shows the hypothesized functional relationships within the instructional use category. Annual hours flown are determined by the rates of new certificate and rating issuances. As in the aerial application user category, the number of desired-active-aircraft is a function of actual hours flown and the desired-aircraft-utilization-rate.

The key to determining fixed wing instructional flying is the rate of issuance for private certificates, commercial certificates, and instrument ratings. Figure 2-20 shows how the average number of instructional hours flown per certificate issued has been increasing since 1967. Fitting an expression of the form $Y = ae^{1/t}$ yields

$$\frac{\text{Instr.Hr.}}{\text{Cert. Issued}} = 58.6\ e^{1/t}$$

which indicates a saturation level of 58.6 instructional hours per certificate issued for fixed wing aircraft. The fraction of fixed wing instructional hours flown by single-engine piston and multi-engine piston are given in Table 2-20. Since there is no apparent trend in the preference of either aircraft type, a simple exponentially smoothed average is used to distribute total fixed wing instructional hours.

A similar analysis applied to helicopter instructional flying yields

$$HF(5,6) = 13.6\ (HCI + HRI)$$

The desired-aircraft-utilization-rates for each aircraft type showed absolutely no correlation with either fixed cost, total cost or GNP. Therefore, the four derived values for each DAUR were exponentially smoothed, yielding

DAUR(5,1) = 416 (hr/aircraft/year)
AT(5,1) = 1 (year)

DAUR(5,3) = 222 (hr/aircraft/year)
AT(5,3) = 1 (year)

DAUR(5,6) = 241 (hr/aircraft/year)
AT(5,6) = 1 (year)

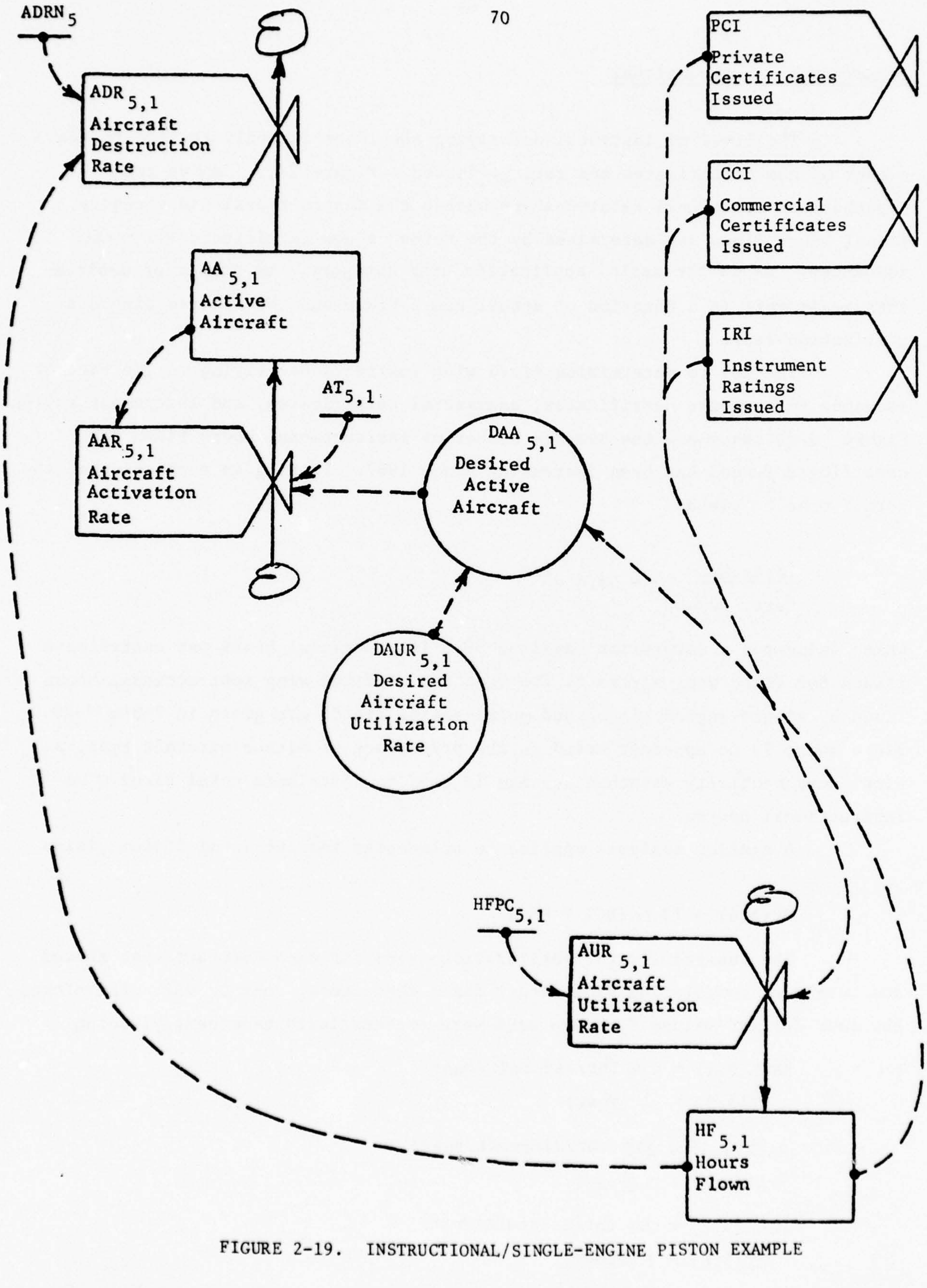

FIGURE 2-19. INSTRUCTIONAL/SINGLE-ENGINE PISTON EXAMPLE

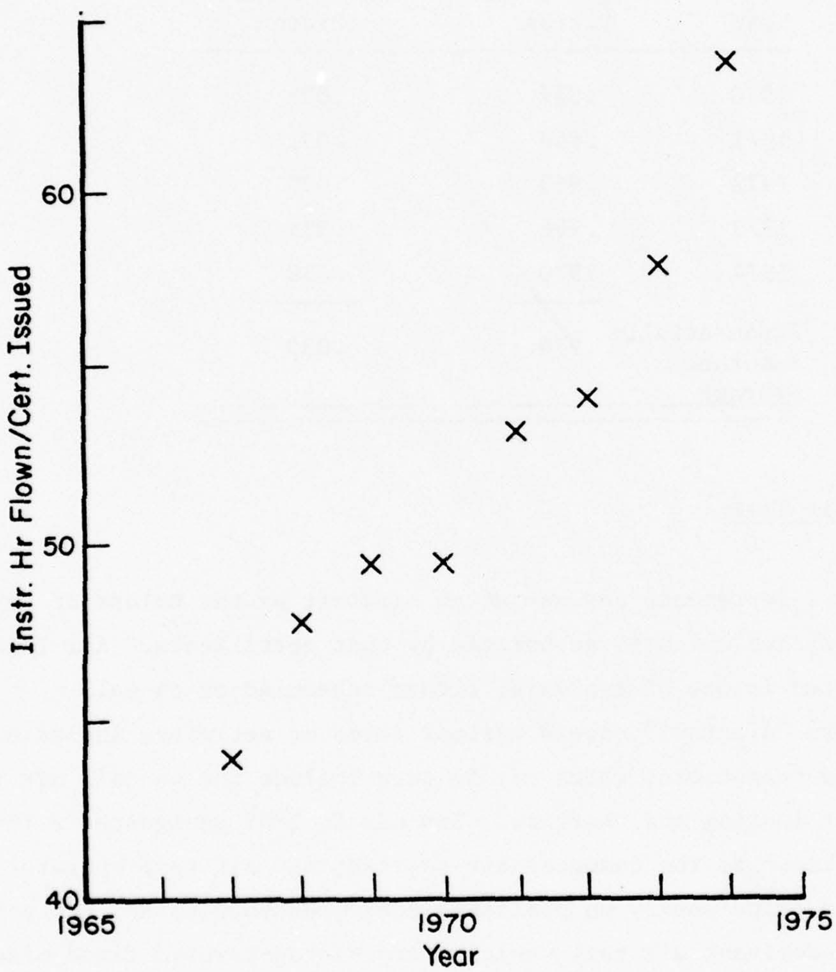

FIGURE 2-20. INSTRUCTIONAL HOURS FLOWN PER CERTIFICATE ISSUED

TABLE 2-20. FRACTION OF FIXED WING INSTRUCTIONAL HOURS FLOWN

Year	Single-Engine Piston	Multi-Engine Piston
1970	.977	.023
1971	.969	.031
1972	.968	.032
1973	.966	.034
1974	.970	.030
Exponentially Smoothed Average	.970	.030

Primary Use - Air Taxi

Air taxi represents any use of an aircraft by the holder of an Air Taxi Operating Certificate which is authorized by that certificate. Air Taxis are generally operated in one of two ways; either scheduled or on-call.

The term "air taxi" covers various forms of activity, including scheduled and nonscheduled operations, which may in turn include the on-call air taxi, as well as aircraft leasing and charters. The CAB in 1969 designated a further subcategory to be known as the commuter air carrier; any air taxi operator flying at least five round trips weekly on published schedules between any two points.

The predominant air taxi vehicles are piston-powered fixed wing aircraft. However, there are significant numbers of all aircraft types within the air taxi category (except aircraft type 2). Only the piston powered helicopter has shown a reduction in numbers over the past few years.

The demand for air taxi services is likely to be a derived demand for total annual air taxi hours flown. Figure 2-21 shows the growth that air taxi has experienced during the early 1970s. As certificated air carrier operations are reduced, especially at remote locations, air taxi activity would be expected to increase. Air taxi activity should also be dependent on the level of real economic activity

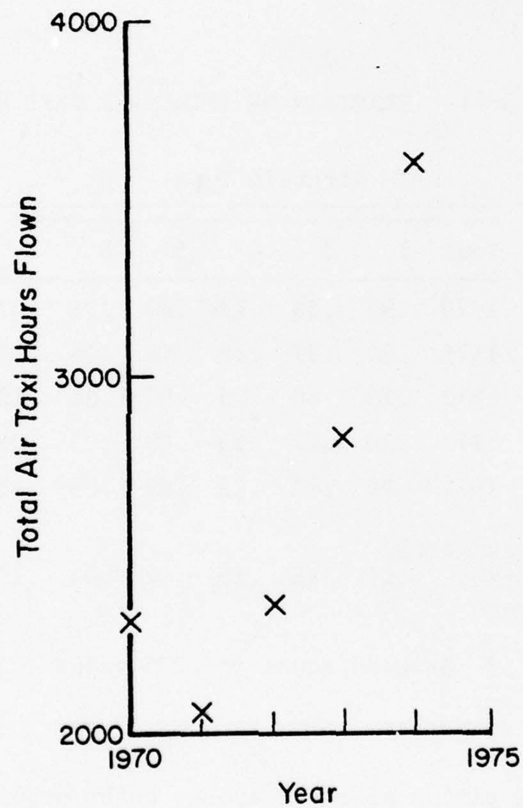

FIGURE 2-21. ANNUAL AIR TAXI HOURS FLOWN

within the U. S. Figure 2-22 displays the annual hours flown as a function of GNP divided by MI. A fit to these data yields

$$\sum_{J=1,\ 3-7} HF(6,J) = -8,330,000 + 10,791,000* \frac{GNP}{MI}$$

Table 2-21 indicates the fraction of total air taxi hours flown by each aircraft type.

TABLE 2-21. FRACTION OF TOTAL AIR TAXI HOURS

	Aircraft Type					
Year	1	3	4	5	6	7
1970	.30	.38	.18	.01	.06	.07
1971	.31	.37	.16	.01	.06	.09
1972	.29	.40	.15	.02	.04	.10
1973	.30	.42	.13	.03	.03	.09
1974	.22	.47	.13	.02	.03*	.13
Exponentially Smoothed Average	.27	.42	.15	.02	.04	.10

* Assumed equal to 1973 value

Multi-engine piston aircraft appear to be providing an ever increasing share of the air taxi demand. However, because there are no clear trends, either increasing or decreasing, for the other aircraft types, a simple exponentially smoothed average was used to distribute future forecast of total hours between each aircraft type.

Figure 2-23 shows the hypothesized model of causal behavior for turbojets within the air taxi category. Annual hours flown represents a derived demand which is dependent upon both the GNP and the level of commercial air activity. The desired number of active air taxi aircraft is related to the desired aircraft utilization rate and the actual aircraft utilization rate last year. No significant correlation could be determined between DAUR and any of the potential explanatory variables. Exponentially smoothed averages for each DAUR are

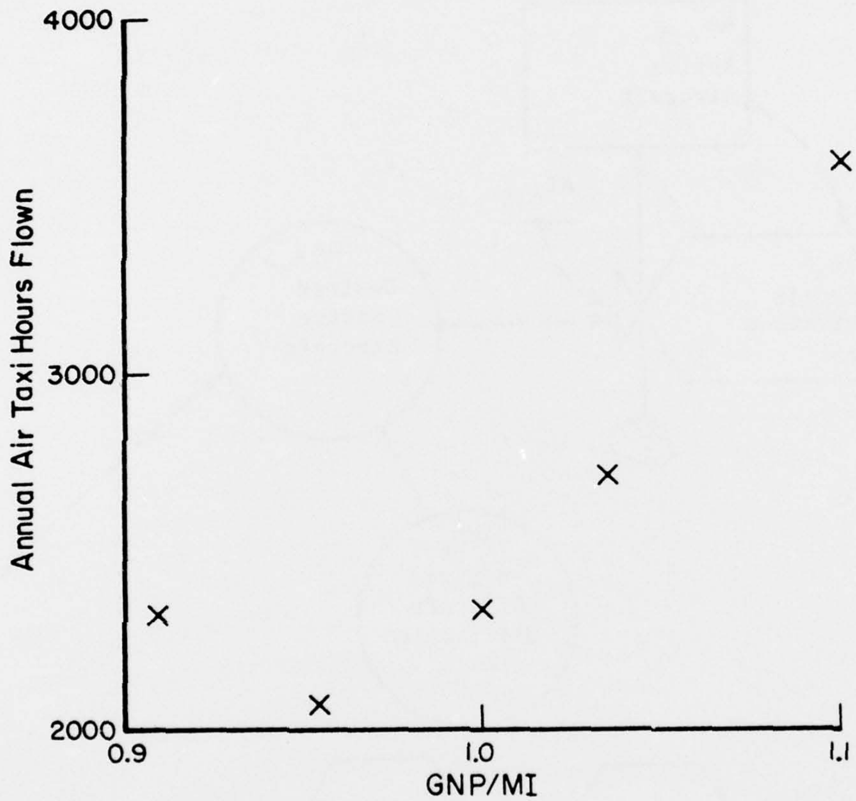

FIGURE 2-22. ANNUAL AIR TAXI HOURS FLOWN AS A FUNCTION OF GNP/MI (Each Indexed to Their 1972 Values)

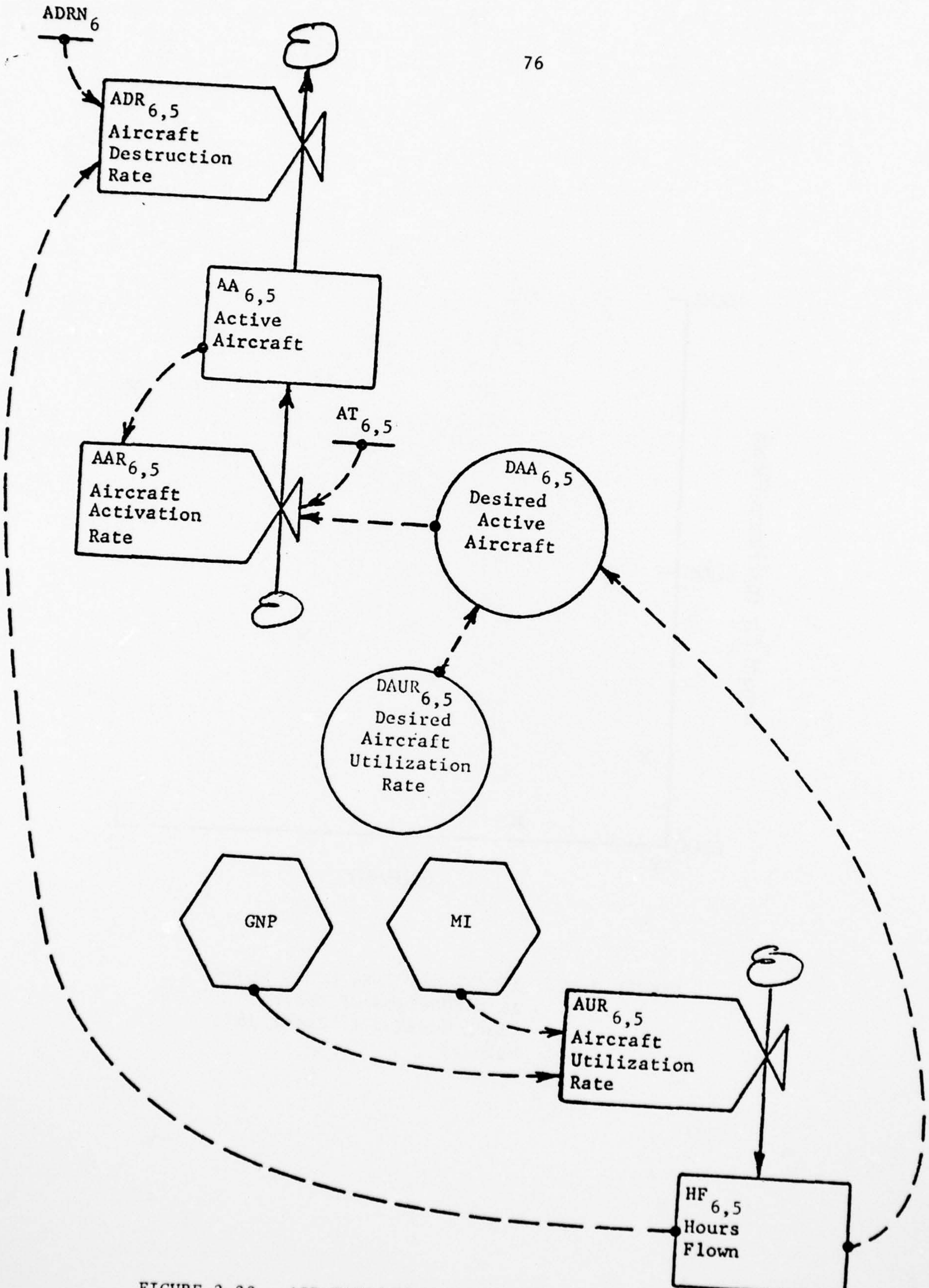

FIGURE 2-23. AIR TAXI/TURBOJET EXAMPLE

DAUR(6,1) = 386 (hours/aircraft/year)
DAUR(6,3) = 414 "
DAUR(6,4) = 1269 "
DAUR(6,5) = 440 "
DAUR(6,6) = 510 "
DAUR(6,7) = 530 "

with each having a corresponding adjustment time AT = 1 year.

Primary Use - Other

The "other" user category is comprised of rental, industrial/special, and other applications. Industrial/special is any use of an aircraft for specialized work allied with industrial activity; excluding transportation and aerial application. Examples are pipe line patrol, survey, advertising, photography, helicopter hoist, etc. Other use is any use of an aircraft not accounted for by the previous user categories. Each of the six non specialized aircraft types are represented in this combined category. However, the piston powered fixed wing aircraft are predominantly rental aircraft, rotary wing aircraft are predominantly industrial/special, and most turboprops are turbojets are reported to be "other" primary use.

The hypothesized structure of the predominantly rental portion of "other" use is illustrated in Figure 2-24. Figure 2-25 shows the annual hours flown data for single engine and multi-engine piston fixed wing aircraft. Rental activity can be expected to increase with the number of active pilots (potential renters) and also with the relative level of individual affluence, DPI. The annual activity data is plotted versus the product of (normalized) DPI and active pilots (CP + PP) in Figure 2-26. Linear regression analysis applied to these data indicate the following relationship for forecasting the annual demand for (essentially) rental activity:

$$HF(7,1) = 913\left(-5309 + .0173\ DPI\ (PP+CP)\right)$$
$$HF(7,3) = 87\left(-5309 + .0173\ DPI\ (PP+CP)\right)$$

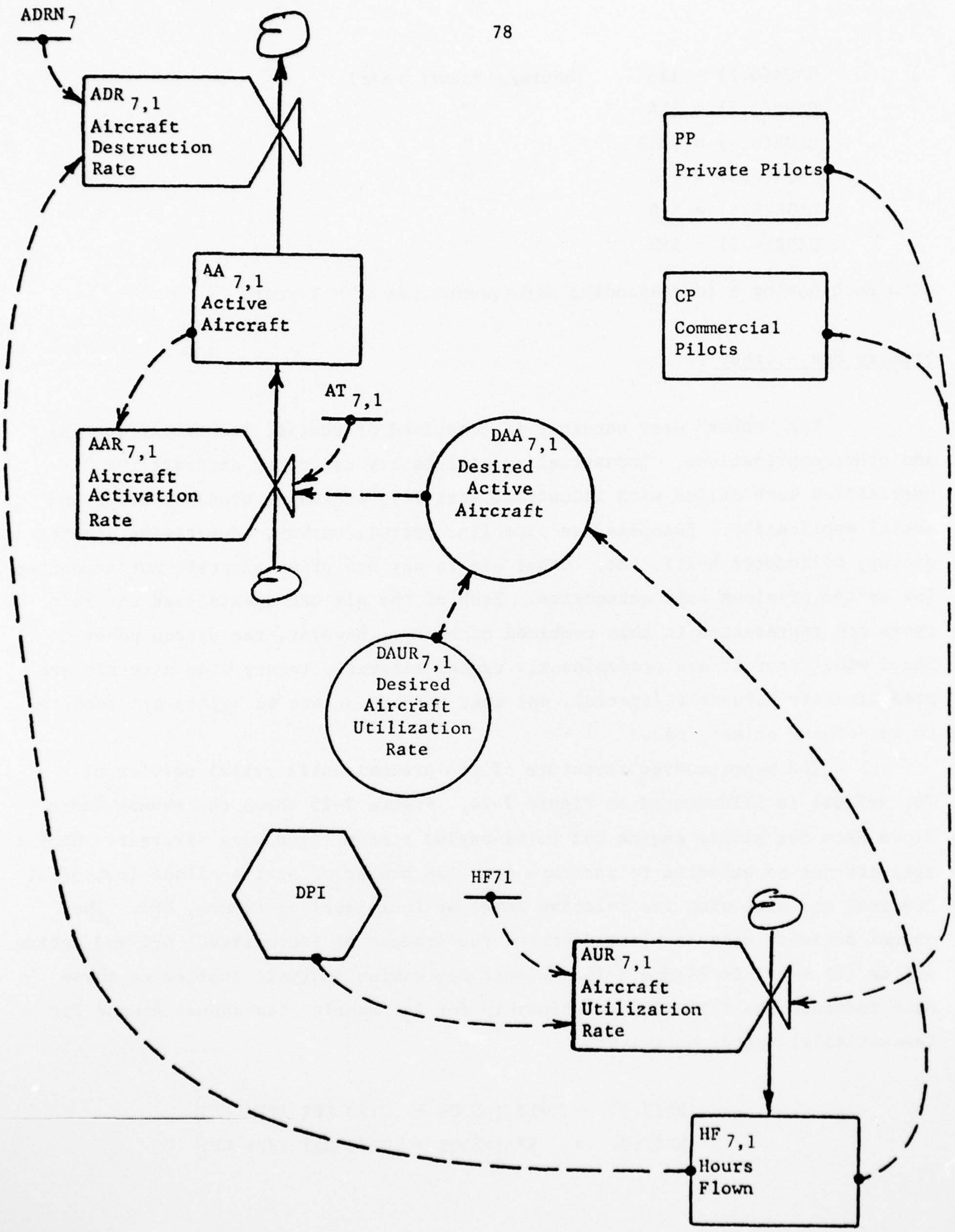

FIGURE 2-24. "OTHER"/SINGLE-ENGINE PISTON EXAMPLE

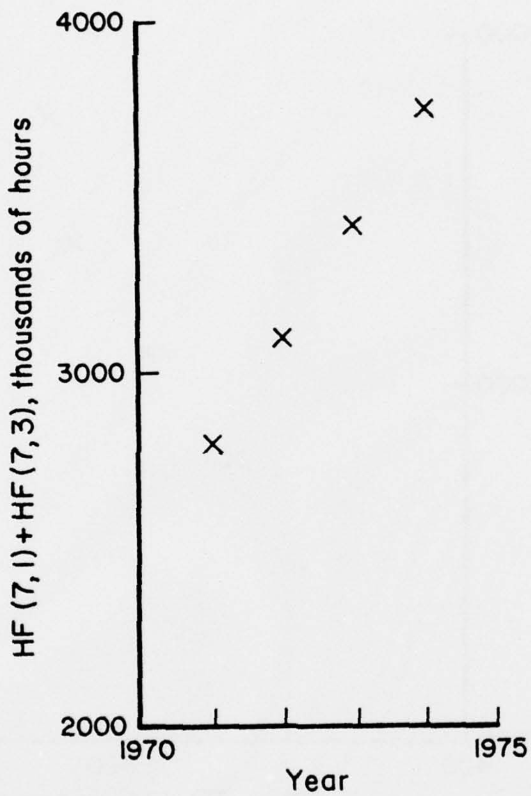

FIGURE 2-25. ANNUAL HOURS FLOWN IN THE OTHER/SINGLE AND MULTI-ENGINE PISTON SUBSEGMENTS

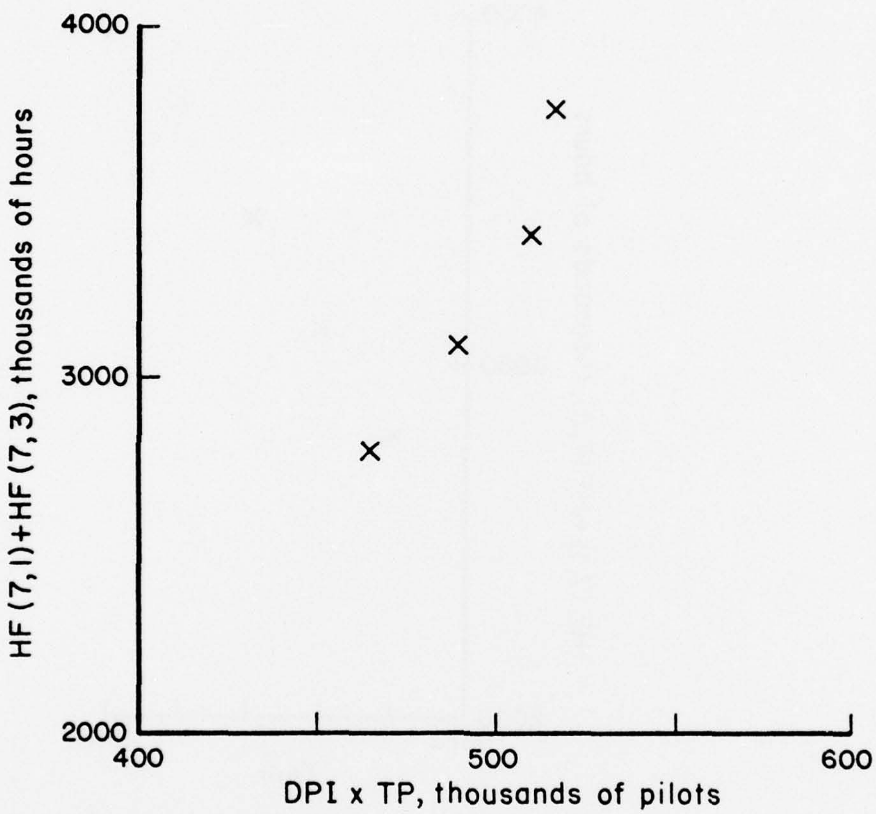

FIGURE 2-26. ANNUAL HOURS FLOWN IN THE OTHER/SINGLE AND MULTI-ENGINE PISTON SUBSEGMENTS AS A FUNCTION OF DPI (INDEXED) TIMES TOTAL PILOTS

Aircraft utilization rates for turboprops and turbojets have been essentially constant within the other category. The average rates are

AURN(7,4) = 436 (hours/aircraft/year)

AURN(7,5) = 237 " " "

For rotary wing aircraft, which are mainly industrial/special applications, the aircraft utilization rates are inversely proportional to their variable cost of operation.

$$AUR(I,J) = AURN(I,J)*VC(J)^{-1.30}$$

AURN(7,6) = 437 (hours/aircraft/year)

AURN(7,7) = 431 " " "

CHAPTER 5. SUPPLEMENTARY MATERIAL

Operations

Within any particular user category/aircraft type subsegment, the average trip time (or flying time per operation) should be relatively constant over time. Using the results of two studies conducted for the FAA (see Volume IV), estimates for the average flying time per operation within each subsegment ($HPO_{i,j}$) were derived. Table 2-22 presents values which are consistent with estimated CY 1973 operations - the latest available data. Simply dividing forecasts for annual hours flown by the appropriate value from Table 2-22, yields reasonable estimates of total operations, functionally

$$OPS_{i,j} = HF_{i,j}/HPO_{i,j}$$

where $OPS_{i,j}$ represents total annual operations within the i th user category by aircraft type j.

TABLE 2-22. CY 1973 HOURS/OPERATION

User Category I	Aircraft Type J: 1	2	3	4	5	6	
1	.18		.14			.38	
2	.25		.59	.20	.25	.75	
3	.2		.08			.05	
4		2.12	.15			1.86	
5	.16		.07			.34	
6	.26		.38	1.05	.48	8.88	
7	.76		.35	.08	.02	.99	

USER CATEGORIES

1. Business
2. Corporate
3. Personal
4. Aerial
5. Instruct.
6. Air Taxi
7. Other

AIRCRAFT TYPE J

1. Single-Eng. Piston Nonaerial
2. Single-Eng. Piston Aerial
3. Multi-Engine Piston
4. Turboprop
5. Turbojet
6. All Helicopters

Further estimates were made for dividing operations into local versus itinerant at both towered and non-towered airports, and into IFR versus VFR at all airports. Estimated percentages, based on CY 1973 data, are given in Tables 2-23, 2-24, and 2-25.

TABLE 2-23. CY 1973 PERCENT OF LOCAL AND ITINERANT TRAFFIC AT TOWERED AIRPORTS FOR EACH AIRCRAFT TYPE AND USER CATEGORY

User Category I \ Aircraft Type J	1	2	3	4	5	6	
1	.071 .254		.014 .311			.001 .324	
2	.159 .166		.007 .318	.001 .324	.001 .324	.001 .324	
3	.176 .149		.154 .171			.001 .324	
4		.183 .142	.119 .206			.001 .324	
5	.268 .057		.142 .183			.226 .099	
6	0 .325		0 .325	0 .325	0 .325	0 .325	
7	.203 .122		.112 .213	.001 .324	.001 .324	.001 .324	

USER CATEGORY

1. Business
2. Corporate
3. Personal
4. Aerial
5. Instruct.
6. Air Taxi
7. Other

AIRCRAFT TYPE J

1. Single-Eng. Piston Nonaerial
2. Single-Eng. Piston Aerial
3. Multi-Engine Piston
4. Turboprop
5. Turbojet
6. All Helicopters

% Local % Itn.

TABLE 2-24. CY 1973 PERCENT OF LOCAL AND ITINERANT TRAFFIC AT NONTOWERED AIRPORTS FOR EACH AIRCRAFT TYPE AND USER CATEGORY

User Category I	Aircraft Type J						
	1	2	3	4	5	6	
1	.189 .486		.038 .637				
2	.425 .250		.017 .658	.001 .674	.001 .674	.001 .674	
3	.470 .205		.411 .264			.001 .674	
4		.489 .186	.318 .357			.001 .674	
5	.674* .001		.379 .296			.001 .674	
6	0 .675		0 .675	0 .675	0 .675	0 .675	
7	.542 .133		.300 .375	.001 .674	.001 .674	.001 .674	

USER CATEGORY

1. Business
2. Corporate
3. Personal
4. Aerial
5. Instruct.
6. Air Taxi
7. Other

AIRCRAFT TYPE J

1. Single-Eng. Piston Nonaerial
2. Single-Eng. Piston Aerial
3. Multi-Engine Piston
4. Turboprop
5. Turbojet
6. All Helicopters

*Local actually was calculated to be .717 which exceeded allowable limit of .675.

% Local
% Itn.

TABLE 2-25. CY 1973 PERCENT OF G.A. IFR AND VFR OPERATIONS FOR EACH AIRCRAFT TYPE AND USER CATEGORY

Aircraft Type J

User Category I	1	2	3	4	5	6	
1	.033 .967		.097 .903			.017 .983	
2	.052 .948		.126 .874	.173 .827	.201 .799	.017 .983	
3	.016 .984		.042 .958			.039 .961	
4		.004 .996	.016 .984			.001 .999	
5	.004 .996		.008 .996			.001 .999	
6							
7	.009 .995		.043 .957	.001 .999	.004 .996	.001 .999	

Aircraft Type J

User Category I	1	2	3	4	5	6	
1							
2							
3							
4							
5							
6	.072 .928		.176 .824	.227 .773	.241 .759	.001 .999	
7							

% IFR
% VFR

USER CATEGORY

1. Business
2. Corporate
3. Personal
4. Aerial
5. Instruct.
6. Air Taxi
7. Other

AIRCRAFT TYPE J

1. Single-Eng. Piston Nonaerial
2. Single-Eng. Piston Aerial
3. Multi-Engine Piston
4. Turboprop
5. Turbojet
6. All Helicopters

Further estimates were made for dividing operations into local versus itinerant at both towered and non-towered airports, and into IFR versus VFR at all airports. Estimated percentages, based on CY 1973 data, are given in Tables 2-23, 2-24, and 2-25.

Although average flying times and the fraction of operations attributed to itinerant, IFR, etc. are assumed constant over time within a subsegment, the changing mix of operations is preserved by considering activity within distinct subsegments. A detailed description of these derivations is provided in Volume IV.

Fuel Consumption

The annual consumption of both aviation gas and jet fuel is based on consumption rates at 75 percent power. Table 2-26 presents consumption rates which are consistent with the values used by Aviation Data Services, Inc., in determining the variable operating costs. Total estimated fuel consumption is the product of these consumption rates times the appropriate forecast for annual hours flown.

Contributions to Federal Trust Fund

Monies contributed to the Federal Trust Fund by general aviation are collected through the federal fuel tax and federal registration fee. An additional source of revenue could be the imposition of landing fees at FAA towered airports. Although there are presently no federal landing fees, it is possible to institute them during model simulation.

TABLE 2-26. AVERAGE FUEL CONSUMPTION RATES

Aircraft Type	Average Fuel Consumption at 75 Percent Power (gal/hr)
Aviation Gas	
Single-engine piston Non-Aerial Application	11.9
Single-engine piston Aerial Application	13.5
Multi engine piston	33.6
Piston Helicopter	14.0
Jet Fuel	
Turboprop	63.1
Turbojet	336
Turbine Helicopter	25.7

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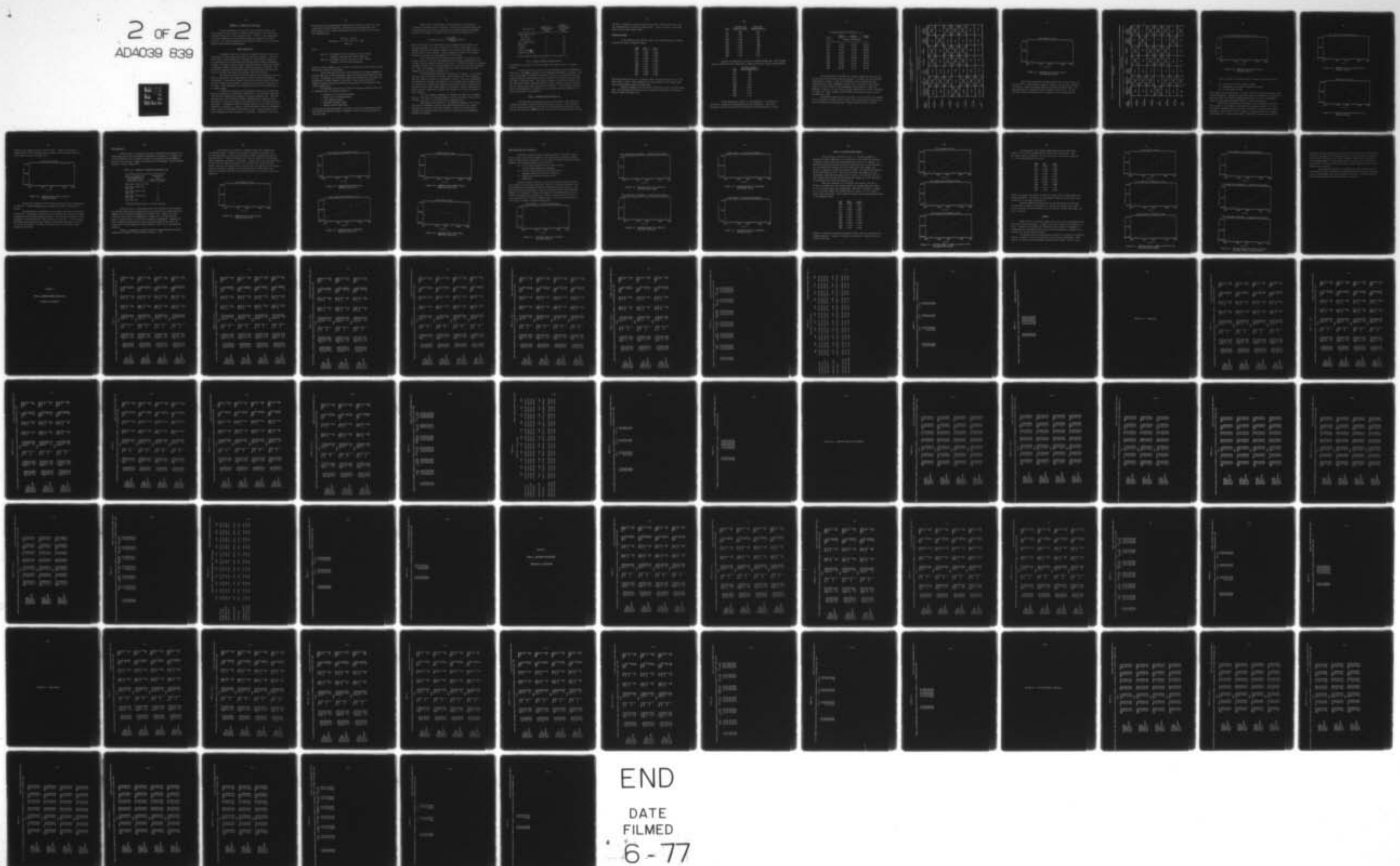

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CHAPTER 6. SIMULATION OF THE MODEL

During development of the General Aviation Dynamics model, many simulations were run in order to increase understanding of its behavior and determine which were its more sensitive parts. Similarly, many combinations of various parameters were tried during regression analyses of the rate equations. The results presented in this chapter pertain to the "best" model based on data available through CY1974.

Model Capabilities

In general, there are two ways to use model results or simulations - individually as projections and in pairs as sensitivity measures. Use of the model simply to make projections is precarious. Many potential users will not understand how the projections were derived and will expect unreasonable accuracy. The model is better used by employing extensive sensitivity analysis to evaluate a range of policies under a range of exogenous conditions. This process will identify the principal areas of model uncertainty and those portions of the model that deserve the greatest additional research.

The logical structure of the GAD model has been constructed such that relative comparisons can be made between the model forecasts from any two simulations. In particular, during a sensitivity analysis, absolute forecasts for each simulation are available, as well as percent deviations between the two cases. These deviations can be displayed over time either graphically or in tabular format.

A sensitivity analysis can be performed between any two simulations which are compatible with the model's capabilities. All GAD model output data from the first simulation are stored on a separate temporary file. This base case need not be the "baseline" forecast representative of expected future conditions, but can be the result of any consistent set of conditions chosen by the analyst. Intermediate absolute forecast results from this base case can be obtained by the analyst, if desired. After obtaining all required intermediate output, the second simulation is specified and run. Absolute results of the second simulation are also available to the analyst. Sensitivity results are

derived within the program logic by subtracting the results of the first simulation from the second simulation, dividing by the first simulation, and multiplying by 100 to convert differences to percent deviations from the base case; mathematically,

$$\% \text{ Deviation} = \frac{AA(I,J)_2 - AA(I,J)_1}{AA(I,J)_1} \times 100$$

where,

$AA(I,J)_1$ = the number of active aircraft of type J within category I from the first (base) simulation

$AA(I,J)_2$ = the number of active aircraft of type J within category I from the second simulation

Values for these parameters are, of course, obtained at the same instant in time during their respective simulations.

Should conditions within the second simulation not change immediately from the base case, percent deviations, until the change becomes effective, will be zero. Furthermore, by continually computing these deviations over time, the non-linearity in model response is preserved. Most previous sensitivity analyses of general aviation activity were predicated on either linear or log-linear sensitivities.

The GAD model can be used to evaluate alternative scenarios which can be translated into an equivalent change in

- o Variable cost of aircraft operation
- o Fixed cost of aircraft ownership
- o Gross national product
- o Disposable personal income
- o Revenue aircraft departures.

As with any forecasting procedure, care must be taken when interpreting results from simulations which are based on parameter values for outside the scope of historical data.

Imposition of landing fees at towered airports is equivalent to increasing the variable cost of operation. Since both the average flight time per operation and the fraction of operations at towered airports are assumed constant, the increment to variable cost (in 1972 $) from landing fee is

$$\Delta \text{ variable cost}_{ij} = \frac{(.325)(LFEE_j)}{2(HPOP_{ij})} * DEFL72$$

where 32.5 percent of all operations occur at towered airports, LFEE is the landing fee imposed (it can be a function of aircraft type), HPOP is the average flight time per operation within the ij category, and DEFL72 converts current dollars to 1972 dollars. These increments are added to the baseline estimates of variable cost and indexed by the 1972 value.

Since variable cost has previously been assumed to be a function of aircraft type only, the most representative value of $HPOP_{ij}$ pertaining to each aircraft type was chosen to preserve this notion. It would be possible to construct a separate variable cost for each subsegment, but this has not yet been incorporated. Thus, the increment to variable cost will be the same within all user categories for a particular aircraft type.

Two possibilities exist when a landing fee is imposed: the increased cost will cause a decrease in activity, some of which will be lost altogether and some of which will divert to non-towered airports. Since most subsegments are unaffected by variable cost directly, it was assumed that no traffic diversion would occur. Business and corporate users who have shown a dependence on variable cost would most likely behave in this manner. However, additional research should be conducted to determine the tendency for GA users to divert to other airports.

Fuel tax is another component of variable cost which can be changed directly. New values, in cents-per-gallon, can be stipulated for either aviation gas or jet fuel at any future point in simulated time.

Requirements for new safety or environmental equipment can be translated into an incremental change in the annualized investment cost centers. The effective increase of this new equipment is based on the depreciation schedules and residual values used by Aviation Data Services in determining annualized investment,

Aircraft Type j	Depreciation Period (years) $DEPREC_j$	*Residual* Value (percent of new cost) $RESID_j$
Single Engine Piston		
Non-Aerial	5	.25
Aerial Appl.	5	.25
Multi Engine Piston	5	.25
Turboprop	6	.28
Turbojet	6	.40
Piston Helicopter	5	.25
Turbine Helicopter	5	.30

The incremental change ΔAI_j measured in 1972 dollars is

$$\Delta AI_j = (DELTA_j(1-RESID_j)/DEPREC_j)*DEFL72$$

where DELTA is the price of the new equipment for aircraft type j in current dollars.

Within the model only four of the 29 subsegments have any dependence on fixed cost. Therefore, the impact of new equipment requirements is minimal. However, since dramatic increases in fixed cost have not yet been experienced, the current behavioral relationships cannot be expected to extrapolate very far past the range of available data. Thus, small increases in fixed cost probably will have the minimal impact indicated; however, larger increases which are evaluated with the present model must be carefully interpreted. If new equipment requirements become mandatory, the general aviation response should be analyzed to update the appropriate relationships.

Case 1. Baseline Versus Ullman Bill

The foundation for planning and policy evaluation by the FAA must be a baseline forecast of uninhibited general aviation activity. Data required for this baseline forecast are entirely self-contained within the model. GNP, DPI and the current dollar deflator are derived from the Wharton national economy

forecasts. Estimates of revenue aircraft departures, variable and fixed costs are representative of current FAA expectations. Values for each of these parameters are included through CY1984.

Baseline Forecast

In the absence of any new data inputs, the following national economic forecasts are used as exogenous inputs:

YEAR	GNP	DPI
1975	1.0176	1.0443
1976	1.0810	1.0980
1977	1.1360	1.1480
1978	1.1600	1.1790
1979	1.1920	1.2000
1980	1.2250	1.2360
1981	1.2530	1.2510
1982	1.2820	1.2690
1983	1.3080	1.2850
1984	1.3600	1.3330

Both GNP and DPI are measured in constant (1972) dollars and indexed to the 1972 value (1972 = 1.000). These estimates are representative of the baseline forecast from the Wharton national economy model.

Fixed and variable costs of aircraft operation are also required through 1984. The following inflation factors (in constant 1972 dollars) are applied to the 1975 values for these costs:

Year	Variable Cost Inflation Factor	Fixed Cost Inflation Factor
1975	1.000	1.000
1976	.999	.984
1977	1.014	.984
1978	1.028	.984
1979	1.040	.981
1980	1.064	.988
1981	1.088	.998
1982	1.110	1.007
1983	1.127	1.013
1984	1.144	1.019

A measure of commercial air traffic is needed through 1984. The following index for Revenue Aircraft Departures is based upon the most recent FAA projections:

Year	Revenue Aircraft Departures(1972=1.0)
1975	.933
1976	.943
1977	.973
1978	.993
1979	1.023
1980	1.053
1981	1.092
1982	1.112
1983	1.142
1984	1.172

As was discussed in Chapter 3, the estimated U. S. population by age group is required in forecasting active pilot population. The values provided in Table 2-6 are used in projecting the following population figures:

PROJECTED RESIDENT POPULATION OF U.S.

As of July 1	POP(1) 16-24	POP(2) 25-34	POP(3) 35+
	Numbers in Thousands		
1975	35,778	30,783	88,703
1976	35,982	31,353	88,825
1977	36,173	31,803	88,895
1978	35,990	32,123	89,117
1979	35,575	32,745	88,811
1980	34,814	33,388	88,911
1981	34,034	34,194	88,716
1982	32,812	34,227	89,581
1983	31,490	34,501	89,293
1984	30,196	34,791	89,222

An active aircraft is defined as a legally registered civil aircraft for which one or more flight hours are reported. The number of active aircraft outstanding on January 1, 1975, are identified by the 29 significant user category/aircraft type subsegments in Table 2-27. Forecasts of the expected number of active aircraft in each subsegment through January 1, 1985, are presented in Table A-1. Total active aircraft population over time is displayed on Figure 2-27, which indicates that 279,000 active general aviation aircraft are expected by 1985.

The greatest growth in active aircraft is in the business use category which is expected to almost triple by 1985. This represents the compound effect of an increased pilot population and a steadily growing national economy.

TABLE 2-27. ACTIVE AIRCRAFT BY PRIMARY USE - AA(I,J) AS OF JANUARY 1, 1975

User Category I	Aircraft Type J: 1. Single-Eng. Piston Nonaerial	2. Single-Eng. Piston Aerial	3. Multi-Engine Piston	4. Turboprop	5. Turbojet	6. Piston Engine Helicopter	7. Turbine Engine Helicopter
1. Business	26,012	X	7733	X	X	393	X
2. Corporate	1284	X	4253	1636	1279	X	335
3. Personal	73,878	X	2732	X	X	347	X
4. Aerial	X	5712	260	X	X	465	X
5. Instruct.	11,799	X	636	X	X	213	X
6. Air Taxi	2134	X	2842	338	168	192	553
7. Other	11,045	X	1331	146	132	736	376

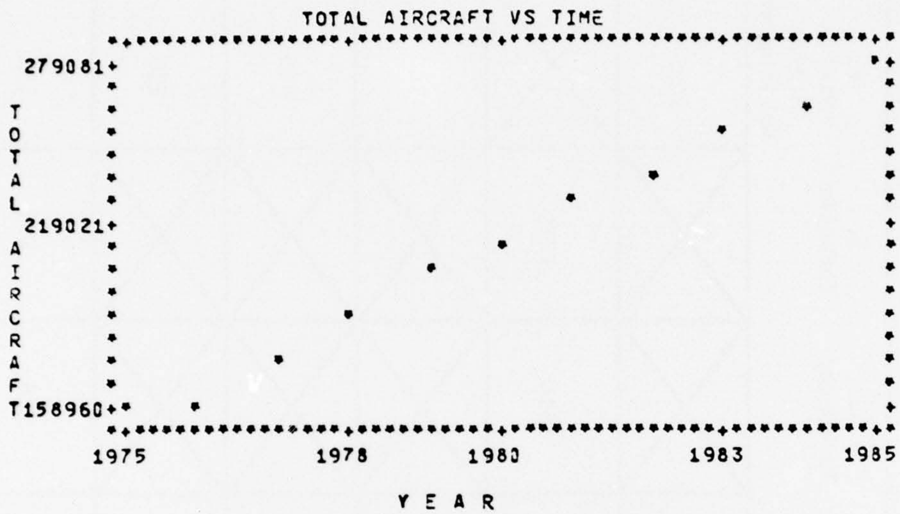

FIGURE 2-27. EXPECTED TOTAL ACTIVE AIRCRAFT FOR BASELINE FORECAST

Table 2-28 contains the estimated annual hours flown by actual use during CY 1974. These data are based on a Bureau of Census survey conducted for the FAA. Table A-2 presents GAD model forecasts through CY 1984. The expected growth in annual hours flown is shown in Figure 2-28. By 1984, the annual level of flying activity is expected to be 50 million hours.

TABLE 2-28. ESTIMATED HOURS FLOWN BY ACTUAL USE - HF(I,J) DURING CY 1974
(thousands)

User Category I	Aircraft Type J: 1. Single-Eng. Piston Nonaerial	2. Single-Eng. Piston Aerial	3. Multi-Engine Piston	4. Turboprop	5. Turbojet	6. Piston Engine Helicopter	7. Turbine Engine Helicopter
1. Business	4160		1640			69	
2. Corporate	294		1480	677	590		142
3. Personal	7830		404			10	
4. Aerial		1820	23			97	
5. Instruct.	5180		161			92	
6. Air Taxi	775		1720	460	74		470
7. Other	3420		340	98	139	356	

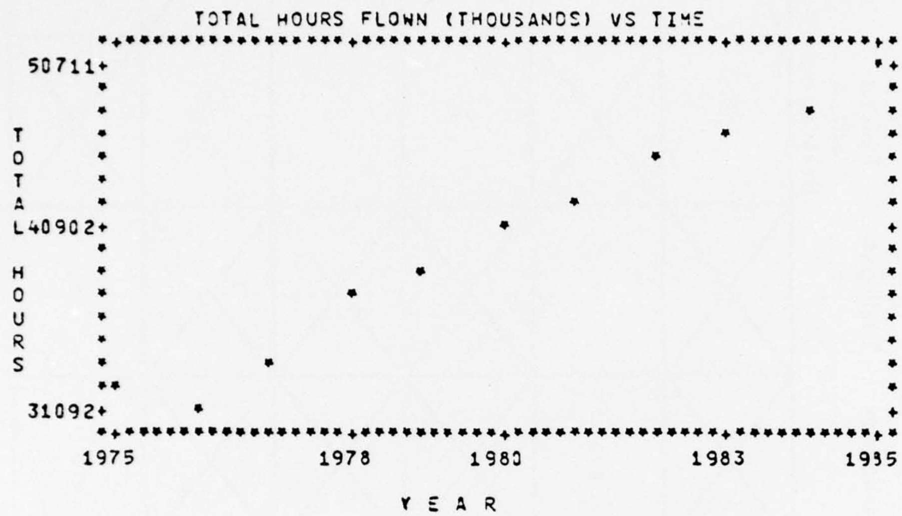

FIGURE 2-28. EXPECTED TOTAL HOURS FLOWN FOR BASELINE FORECAST

Table A-3 gives the estimated number of annual operations identified by

(1) towered local versus towered itinerant

(2) non-towered local versus non-towered itinerant

(3) all IFR versus all VFR

These values are directly related to annual hours flown through the average flight time per operation. Although only the total number of operations are reported for each kind, they are derived by summing appropriately over all 29 subsegments. Figure 2-29 indicates the expected growth in total GA operations.

Active pilot population by certificate type is presented in Table A-4. Also included are the number of helicopter and instrument ratings. Note that the number of student pilots is expected to continually decrease under present conditions. This reflects the U.S. population characteristics and a slightly increasing cost of instructional flying. Figure 2-30 indicates the decrease in

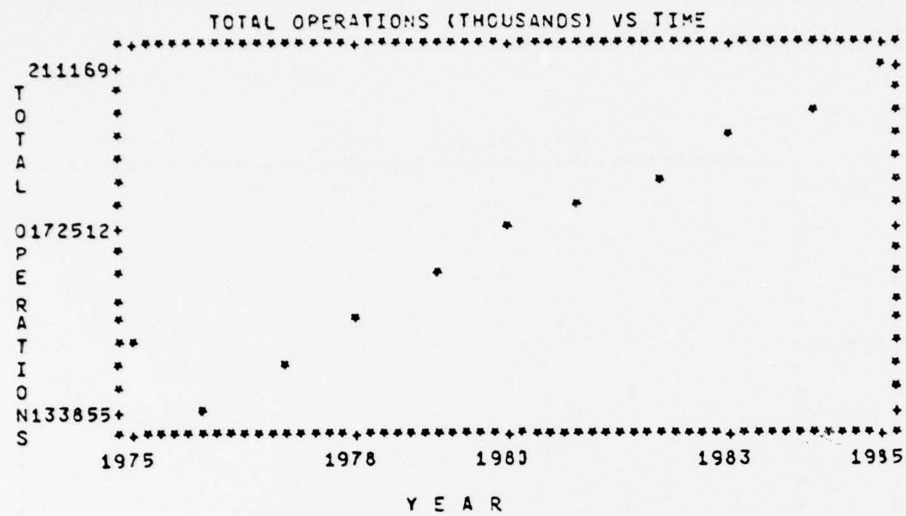

FIGURE 2-29. EXPECTED TOTAL GA OPERATIONS FOR BASELINE FORECAST.

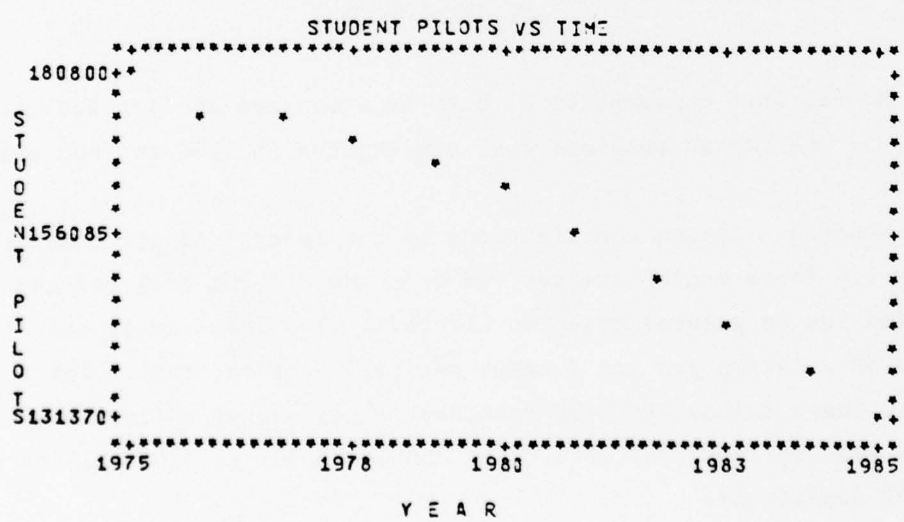

FIGURE 2-30. EXPECTED ACTIVE STUDENT PILOTS FOR BASELINE FORECAST.

student pilots expected over the next ten years. However, the decline in student starts will not decrease the total number of active pilots until the early 1980's, as shown in Figure 2-31.

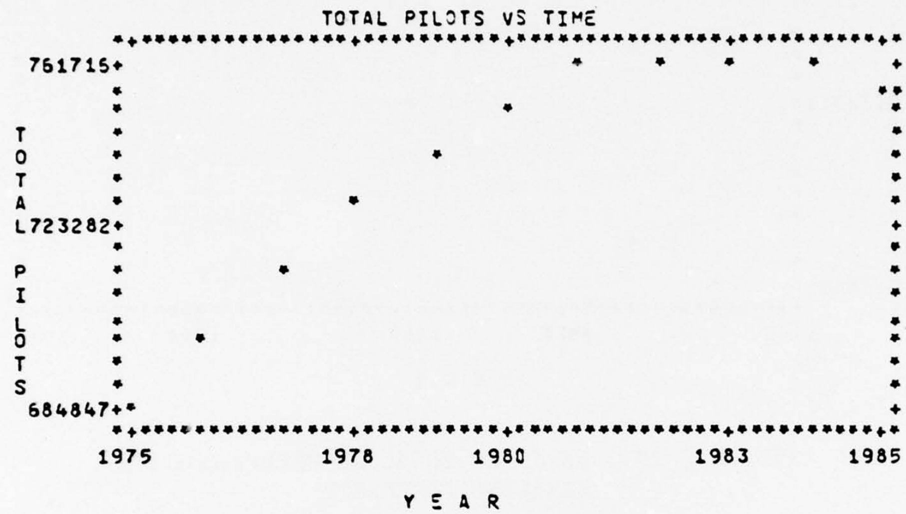

FIGURE 2-31. EXPECTED TOTAL ACTIVE PILOTS FOR BASELINE FORECAST.

Annual fuel consumption of both aviation gas and jet fuel is presented in Table A-5. Estimated combined fuel consumption in 1984 is 1600 million gallons.

General aviation contributions to the federal trust fund are contained in Table A-6. These monies are derived from the federal fuel tax and the federal registration fee on general aviation aircraft. The fuel tax is currently 3 cents per gallon of aviation gas and 7 cents per gallon of jet fuel. For the baseline simulation, these values are held constant. The revenue collected is expressed in current year dollars. By 1984, this should amount to $105 million under present tax conditions.

The Ullman Bill

Various pieces of legislation have been proposed which seek ways to conserve energy and to reduce the Nation's dependence on foreign oil. HR 6860, the revised Ullman Bill, was of primary interest to the general aviation community because of the proposal to impose a conservation tax on gasoline. The tax schedule proposed is shown in Table 2-29.

TABLE 2-29. SCHEDULE OF PROPOSED CONSERVATION TAX

Ratio of Calendar Year Fuel Consumption to Fuel Used in 1973	Conservation Tax (cents per gallon)
Less than or equal to 1.00	3
More than 1.0 but less than 1.01	8
More than 1.01 but less than 1.02	13
More than 1.02 but less than 1.03	18
More than 1.03	23

Since fuel tax is a significant part of the variable cost of operation, the proposed conservation tax should reduce the flying activity within those subsegments that have shown a dependence on variable costs. However, aircraft utilization was found to be independent of variable cost (at least over the range of available data) in 21 of the 29 significant subsegments. Secondary impacts on general aviation activity can be expected through the tax effect on student starts and the demand for aircraft based on total cost of ownership and operation.

Tables A-7 through A-12 present forecasts of general aviation activity, assuming the Ullman Bill becomes effective January 1, 1977.

The conservation tax based on estimated annual fuel consumption is the maximum possible. Because of this effective increase in variable cost, the estimated number of total active aircraft in 1984 is 23,000 less than the baseline forecast. Similarly, annual hours flown are reduced by 5 million and annual operations are reduced by 20 million. Student pilots are also significantly lower than the baseline, because of the increased cost of instructional flying. Even with the reduced level of GA activity, contributions to the federal trust are expected to increase to 457 million dollars in 1984 (Table A-12). Figures 2-32 through 2-36 show the expected evolution in GA activity under these conditions.

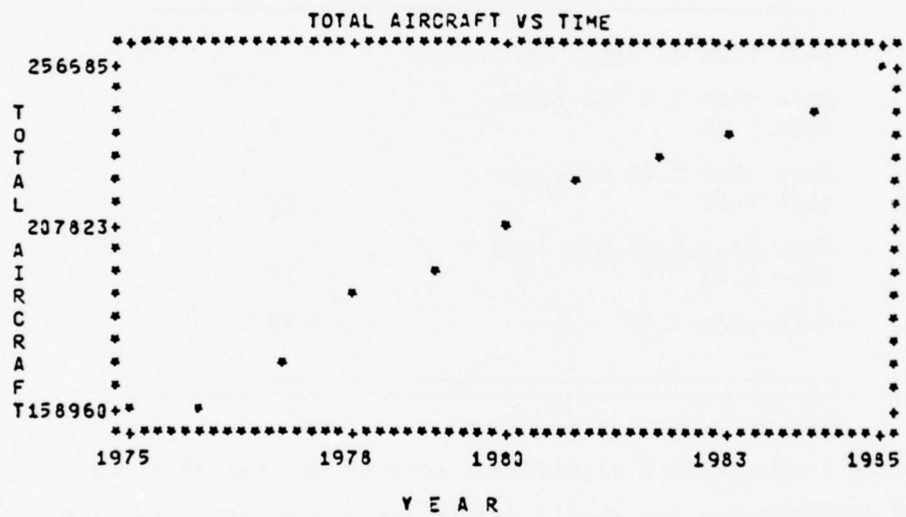

FIGURE 2-32. EXPECTED TOTAL ACTIVE AIRCRAFT UNDER THE ULLMAN BILL.

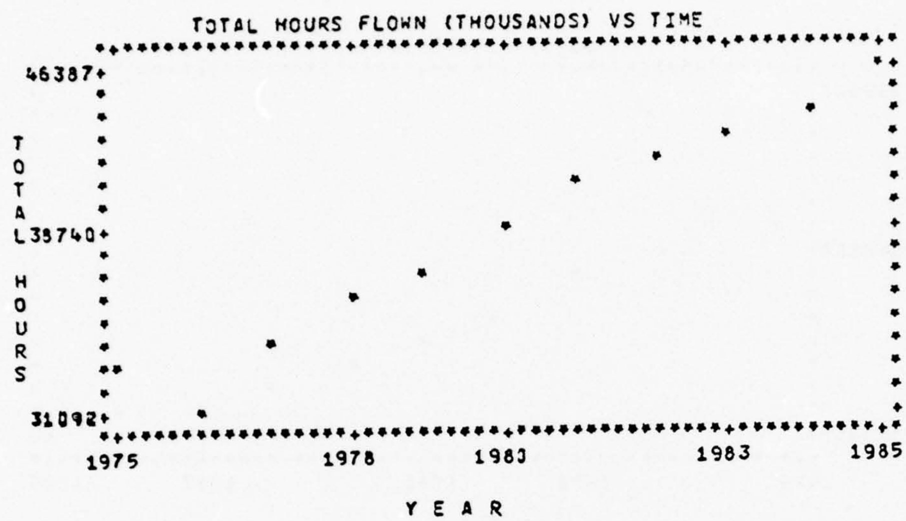

FIGURE 2-33. EXPECTED TOTAL HOURS FLOWN UNDER THE ULLMAN BILL.

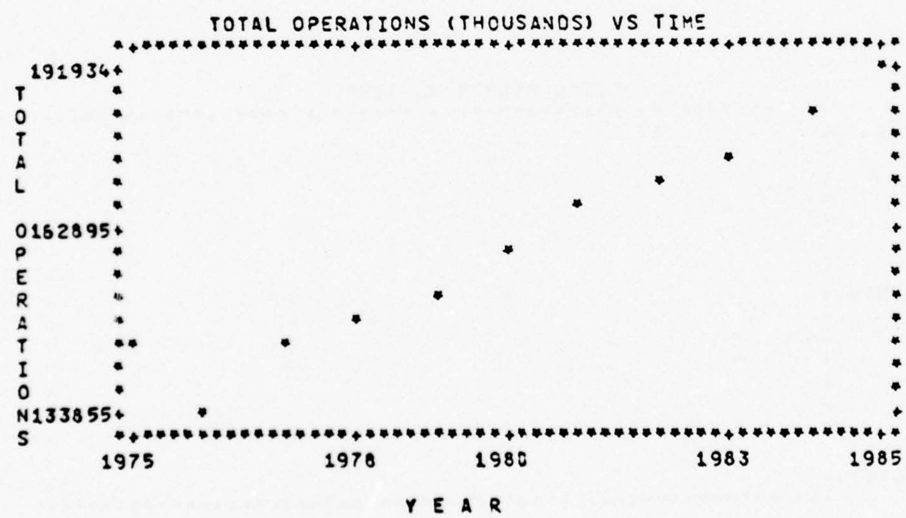

FIGURE 2-34. EXPECTED TOTAL GA OPERATIONS UNDER THE ULLMAN BILL.

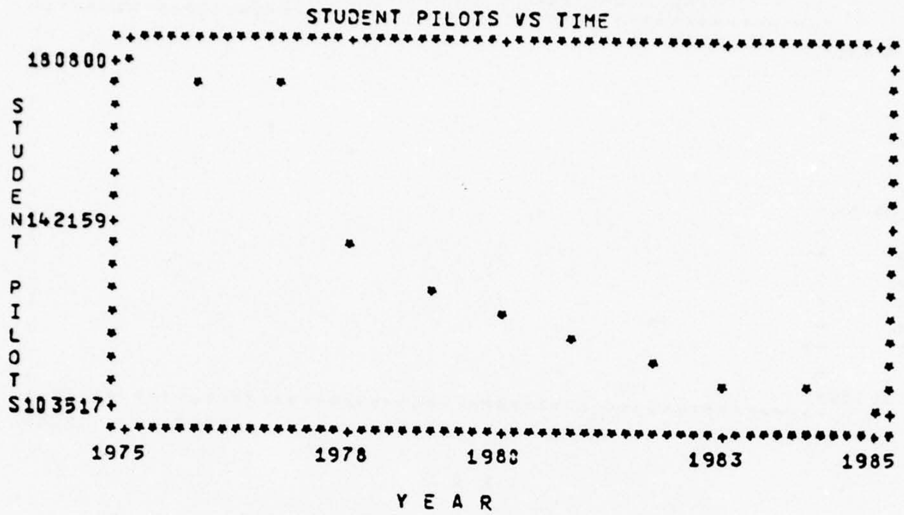

FIGURE 2-35. EXPECTED ACTIVE STUDENT PILOTS
UNDER THE ULLMAN BILL.

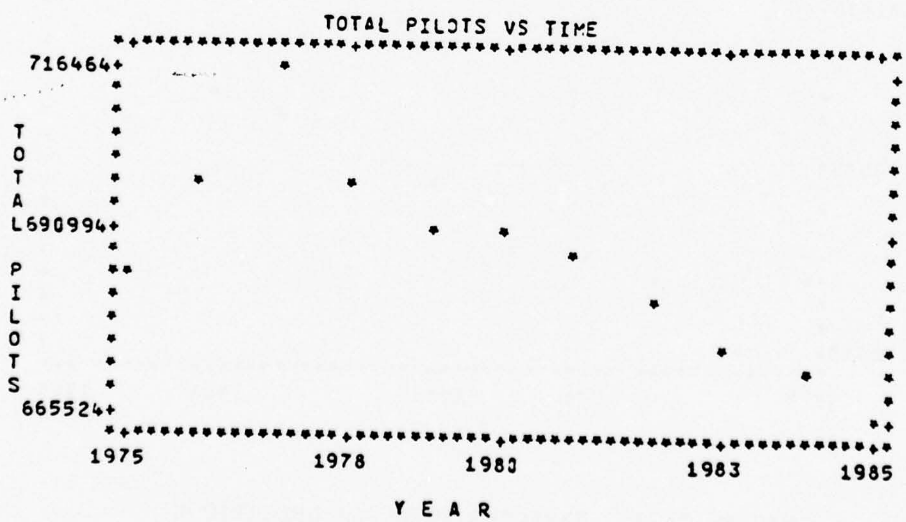

FIGURE 2-36. EXPECTED TOTAL ACTIVE PILOTS
UNDER THE ULLMAN BILL.

Baseline/Ullman Bill Comparison

Sensitivity analyses consist of making changes in the model, usually in the value of a particular parameter, and comparing the evolution of general aviation simulated with the change to the evolution simulated without the change. Normally, the following sequence of events occurs,

(1) run the first simulation which becomes the base case for future sensitivity analyses,

(2) run the second simulation which incorporates a parameter change from the first simulation,

(3) compare the differences between the two simulations.

Using the baseline forecast for the first simulation and the Ullman Bill forecast for the second simulation, Tables A-13 through A-19 present relative comparisons of the expected evolution of general aviation activity. Comparative results are presented in terms of percent deviation from the baseline. Figures 2-37 through 2-41 indicate that adoption of the Ullman Bill can be expected to decrease active aircraft by 8 percent, total hours by 8.5 percent, total operations by 9.1 percent, student pilots by as much as 25 percent, and total pilots by almost 12 percent through 1984.

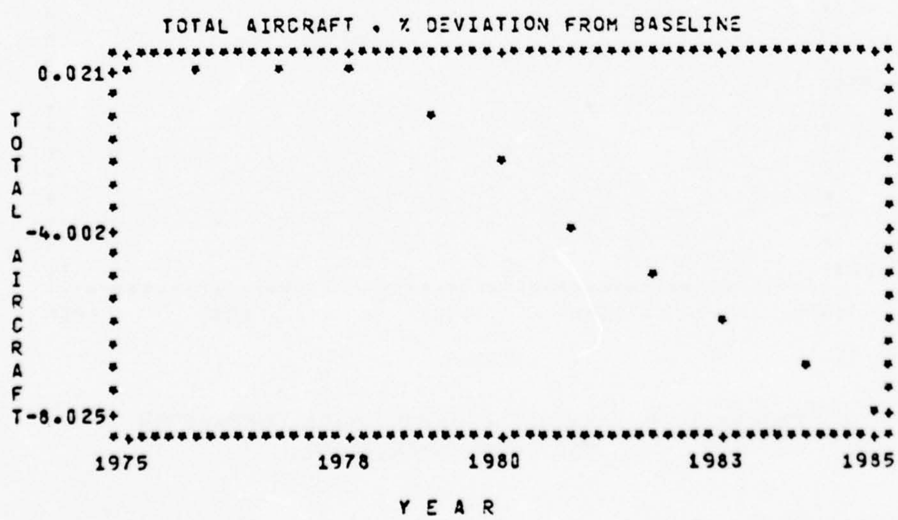

FIGURE 2-37. BASELINE/ULLMAN BILL COMPARISON FOR TOTAL AIRCRAFT.

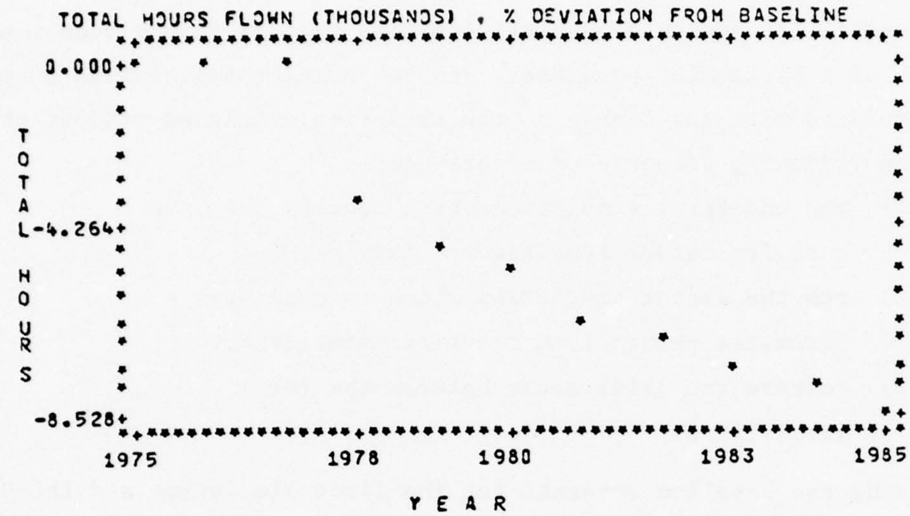

FIGURE 2-38. BASELINE/ULLMAN BILL COMPARISON FOR TOTAL HOURS FLOWN.

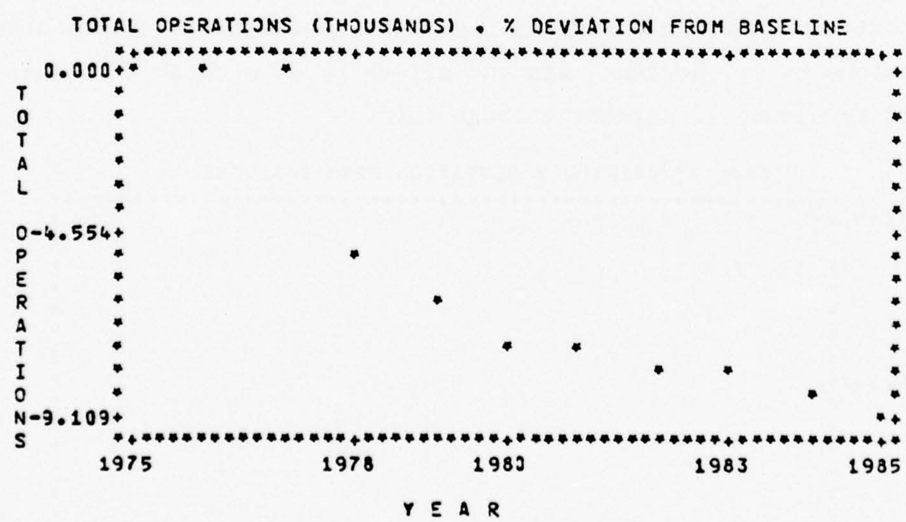

FIGURE 2-39. BASELINE/ULLMAN BILL COMPARISON FOR TOTAL OPERATIONS.

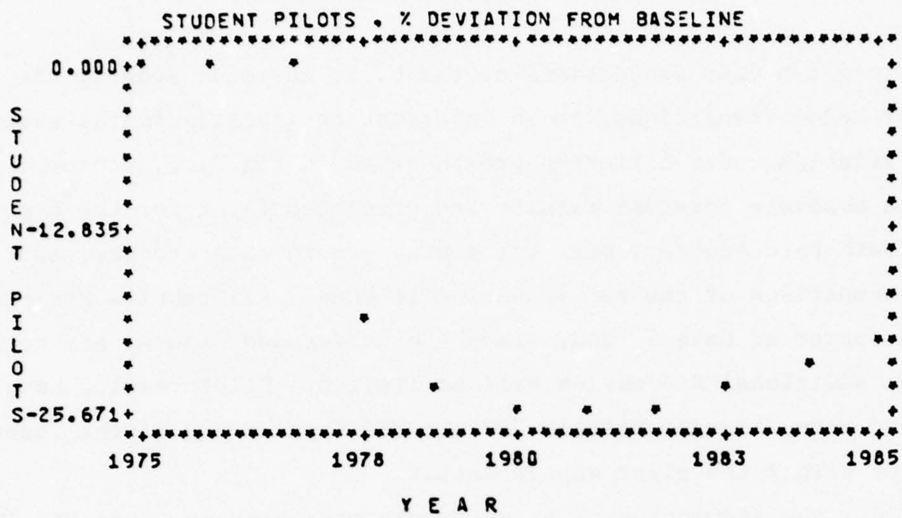

FIGURE 2-40. BASELINE/ULLMAN BILL COMPARISON FOR STUDENT PILOTS.

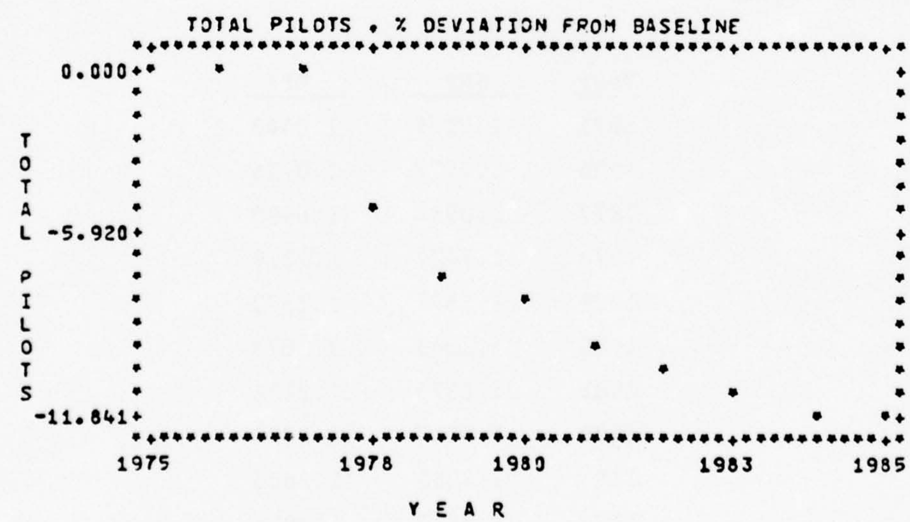

FIGURE 2-41. BASELINE/ULLMAN BILL COMPARISON FOR TOTAL PILOTS.

Case 2. Low Versus High Economy

Since ten year projections of the U. S. national economy are required for model simulations, it is important to investigate the evolution of general aviation under differing growth rates in the U. S. economy. In this section absolute forecast results are presented first for the hypothesis of a low growth rate economy, next for a high growth rate economy, and finally, a comparison of the two scenarios is made. All results are presented in the same format as Case 1 and, since the tables and figures are self-explanatory, additional discussion will be limited. Pilot results have not been included here, because neither GNP nor DPI impacts any of the functional relationships within the pilot supply sector.

Under the assumption of a low growth rate economy, real GNP is assumed to increase at a 3.94 percent annual rate through 1980 and, thence, at a 2.67 percent annual rate through 1984. Real DPI is assumed to increase at a 2.60 percent annual rate through 1980 and, thence, at a 2.17 percent annual rate through 1984. These conditions require the following modifications to the exogenous inputs,

Year	GNP	DPI
1975	1.0176	1.0443
1976	1.0577	1.0715
1977	1.0994	1.0993
1978	1.1427	1.1279
1979	1.1877	1.1572
1980	1.2345	1.1873
1981	1.2675	1.2131
1982	1.3013	1.2394
1983	1.3360	1.2663
1984	1.3717	1.2938

Tables B-1 through B-5 present the expected results under the low growth rate economy assumption. Figure 2-42 displays the evolution of general aviation activity over time.

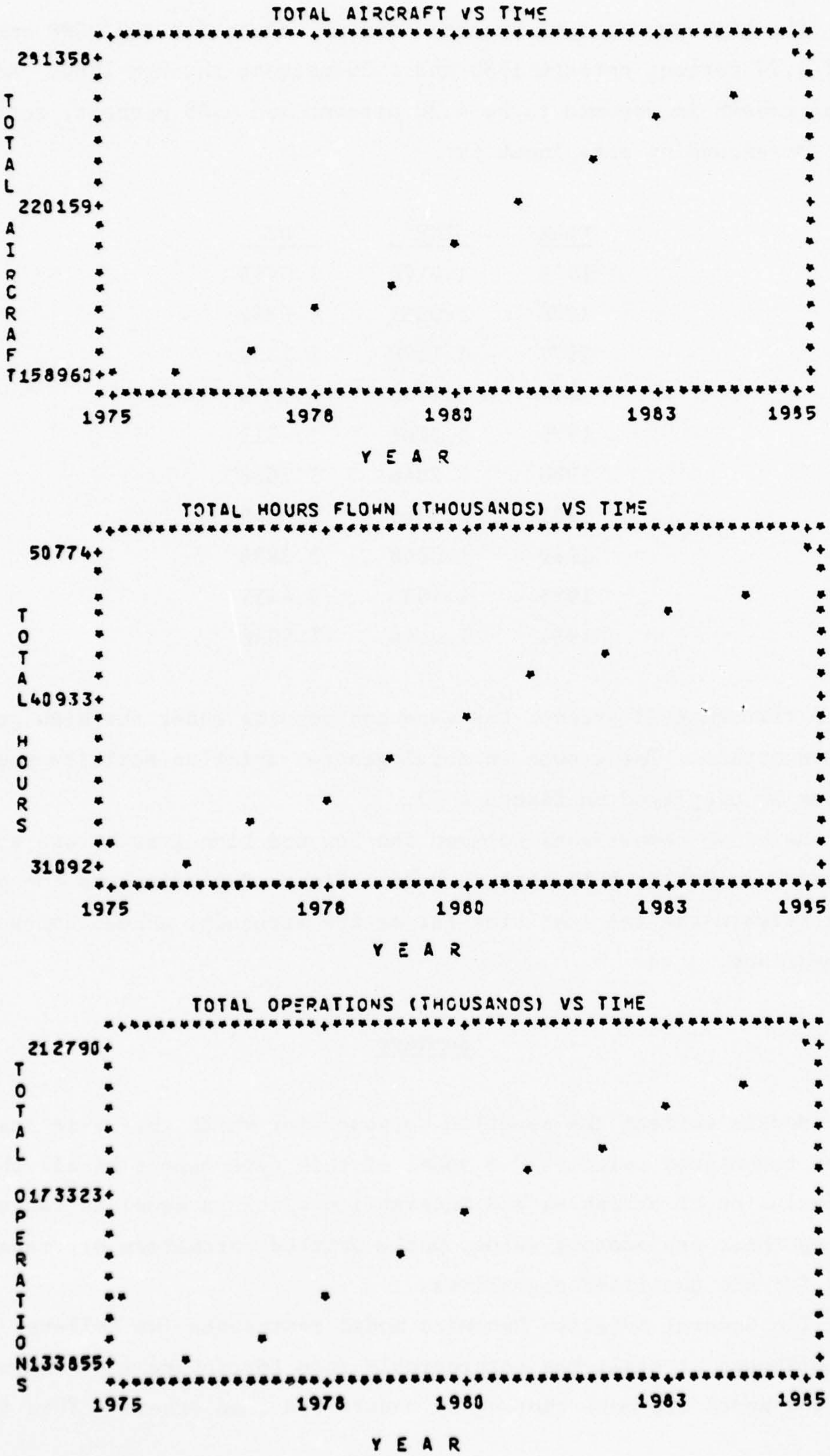

FIGURE 2-42. EXPECTED GROWTH OF GENERAL AVIATION IN THE LOW GROWTH RATE ECONOMY.

The high growth rate economy assumes values for real GNP annual growth of 4.77 percent through 1980 and 4.20 percent through 1984. Real DPI annual growth is assumed to be 4.20 percent and 4.05 percent, respectively. The corresponding data input is:

YEAR	GNP	DPI
1975	1.0176	1.0443
1976	1.0661	1.0882
1977	1.1170	1.1339
1978	1.1703	1.1815
1979	1.2261	1.2311
1980	1.2846	1.2828
1981	1.3385	1.3348
1982	1.3948	1.3888
1983	1.4533	1.4451
1984	1.5144	1.5036

Tables B-6 through B-10 present the expected results under the high growth rate economy assumption. The growth in total general aviation activity under these assumptions is displayed on Figure 2-43.

Relative comparisons between the low and high growth rate economies are presented in Tables B-11 through B-15. Figure 2-44 displays the percent deviation between the two scenarios for active aircraft, annual hours flown, and total operations.

Summary

Models reflect the specific purposes for which they were designed and the particular techniques selected. A model of this type cannot be all things to all users. Inclusion of variables and interaction within a model is tantamount to recognizing their explanatory value, while omitted parameters are regarded as unimportant for the specified objectives.

The General Aviation Dynamics model represents (we believe) a significant advance, although it still has considerable room for future improvement. Some parts of the model are more thoroughly understood than others. This is partly

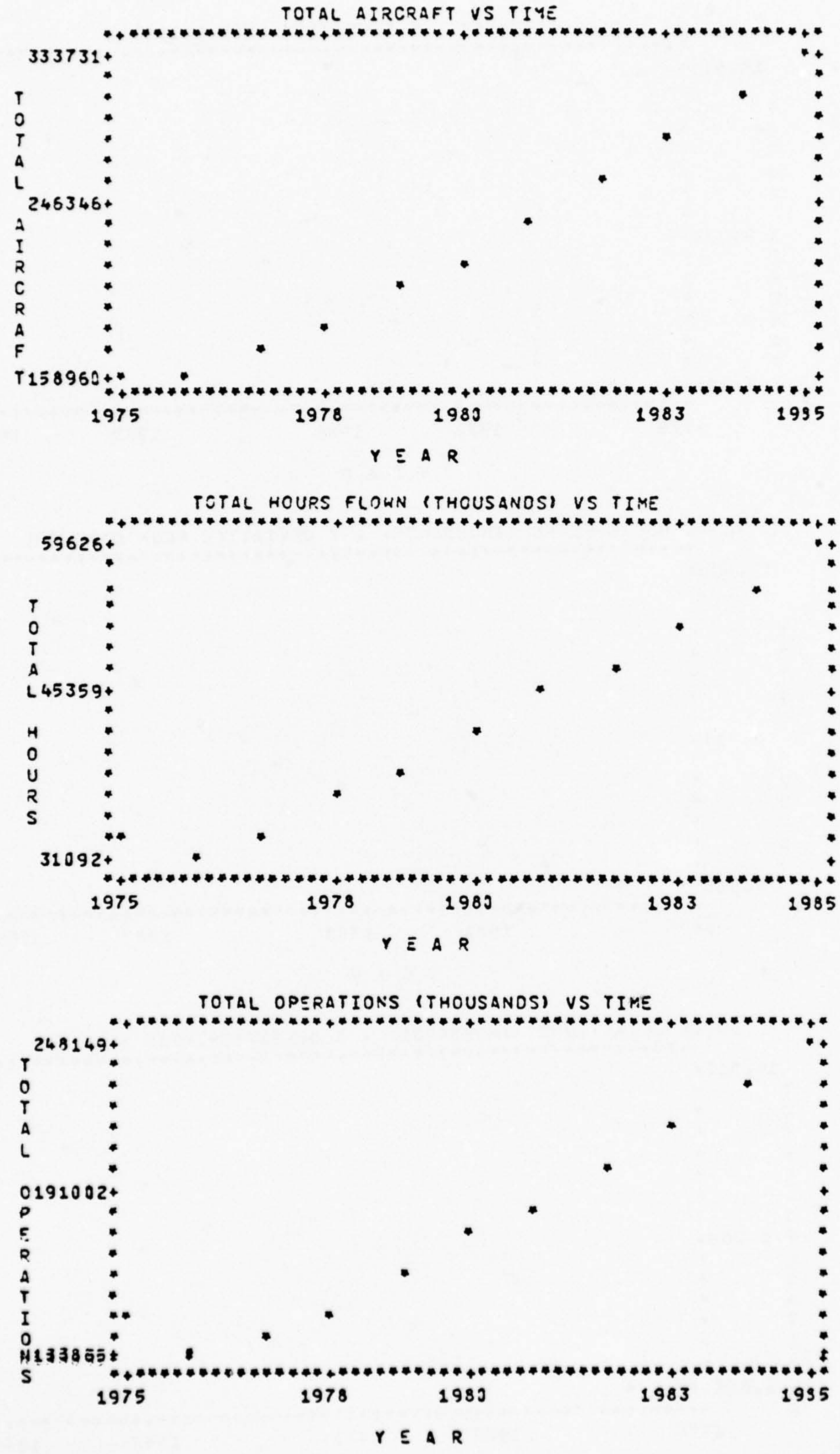

FIGURE 2-43. EXPECTED GROWTH OF GENERAL AVIATION IN THE HIGH GROWTH RATE ECONOMY.

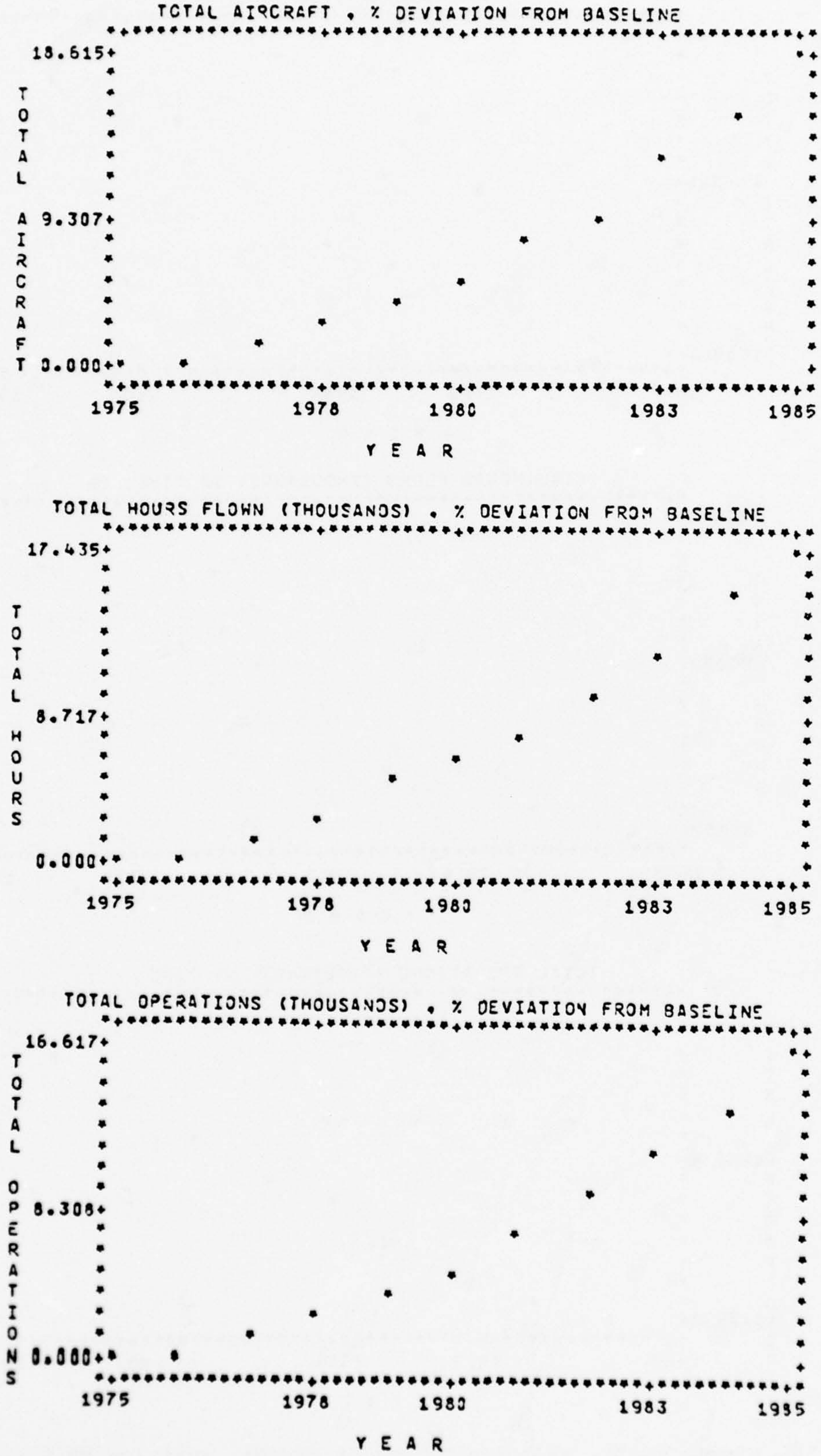

FIGURE 2-44. LOW/HIGH GROWTH RATE ECONOMY COMPARISON FOR TOTAL GENERAL AVIATION ACTIVITY.

because of the data availability and partly because of the more stable behavior of certain subsegments within general aviation. For this reason, the model is better judged according to its overall structure, rather than by scrutiny of its individual parts. The real significance of the model is in the structure which defines the casual interactions between various components of the entire general aviation system.

In applying the GAD model to problems other than those for which it was designed, it may be necessary to introduce modifications, append additional sectors, and elaborate some sectors already in the model. The basic approach has been demonstrated; future applications are numerous.

APPENDIX A

CASE 1. BASELINE VERSUS ULLMAN BILL

Section A.1. Baseline

TABLE A-1.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	158,960	126,152	5,712	19,787	2,120	1,579	2,346	1,264
BUSINESS	34,138	26,012	0	7,733	0	0	393	0
CORPORATE	8,787	1,284	0	4,253	1,636	1,279	0	335
PERSONAL	76,957	73,878	0	2,732	0	0	347	0
AERIAL	6,437	0	5,712	260	0	0	465	0
INSTRUCTIONAL	12,648	11,799	0	636	0	0	213	0
AIR TAXI	6,227	2,134	0	2,842	338	158	192	553
OTHER	13,766	11,045	0	1,331	146	132	736	376

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	161,458	125,606	6,602	21,103	1,876	1,594	2,236	1,441
BUSINESS	34,373	25,075	0	7,903	0	0	396	0
CORPORATE	8,325	1,151	0	4,219	1,384	1,300	0	271
PERSONAL	76,687	73,765	0	2,593	0	0	329	0
AERIAL	7,058	0	6,602	129	0	0	327	0
INSTRUCTIONAL	13,409	12,308	0	721	0	0	380	0
AIR TAXI	7,699	1,989	0	4,126	352	167	176	880
OTHER	13,916	11,318	0	1,412	141	127	629	290

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	171,374	134,814	6,958	21,781	2,150	1,773	2,546	1,352
BUSINESS	38,780	29,537	0	8,698	0	0	445	0
CORPORATE	9,266	1,336	0	4,546	1,615	1,443	0	324
PERSONAL	82,171	78,985	0	2,836	0	0	350	0
AERIAL	7,691	0	6,958	255	0	0	479	0
INSTRUCTIONAL	12,223	11,364	0	662	0	0	197	0
AIR TAXI	7,296	2,384	0	3,455	394	155	267	641
OTHER	13,947	11,106	0	1,329	141	176	808	387

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	188,929	147,991	7,390	24,642	2,413	2,046	2,856	1,591
BUSINESS	45,400	34,992	0	9,906	0	0	503	0
CORPORATE	10,327	1,499	0	5,004	1,808	1,648	0	369
PERSONAL	87,093	83,625	0	3,095	0	0	373	0
AERIAL	8,169	0	7,390	270	0	0	508	0
INSTRUCTIONAL	12,212	11,340	0	651	0	0	201	0
AIR TAXI	8,[illegible]80	2,803	0	4,063	465	182	313	754
OTHER	17,159	13,733	0	1,643	141	217	957	468

TABLE A-1. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	203,403	159,229	7,794	26,902	2,523	2,256	3,011	1,688
BUSINESS	51,397	39,759	0	11,108	0	0	530	0
CORPORATE	11,035	1,568	0	5,358	1,890	1,829	0	389
PERSONAL	91,137	87,481	0	3,264	0	0	392	0
AERIAL	8,615	0	7,794	285	0	0	536	0
INSTRUCTIONAL	12,133	11,275	0	657	0	0	200	0
AIR TAXI	9,070	2,963	0	4,295	492	192	331	797
OTHER	20,016	16,183	0	1,935	141	234	1,021	502

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	216,662	169,488	8,193	28,943	2,636	2,463	3,177	1,763
BUSINESS	57,855	44,871	0	12,419	0	0	565	0
CORPORATE	11,738	1,662	0	5,706	2,003	2,012	0	415
PERSONAL	94,569	90,758	0	3,402	0	0	409	0
AERIAL	9,055	0	8,193	300	0	0	562	0
INSTRUCTIONAL	11,960	11,112	0	648	C	0	200	0
AIR TAXI	9,086	2,968	0	4,302	493	193	332	798
OTHER	22,341	18,117	0	2,166	141	258	1,109	550

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	230,259	180,130	8,478	31,050	2,748	2,671	3,349	1,833
BUSINESS	64,845	50,398	0	13,842	0	0	604	0
CORPORATE	12,570	1,759	0	6,055	2,118	2,196	0	442
PERSONAL	98,415	94,403	0	3,582	C	0	430	G
AERIAL	9,373	0	8,478	309	0	0	586	0
INSTRUCTIONAL	11,767	10,930	0	637	0	0	200	0
AIR TAXI	9,017	2,946	0	4,270	489	191	329	792
OTHER	24,271	19,594	0	2,355	141	283	1,200	599

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	242,692	189,797	8,706	33,102	2,842	2,855	3,485	1,894
BUSINESS	71,830	55,905	0	15,294	0	0	631	0
CORPORATE	13,270	1,841	0	6,378	2,214	2,371	0	466
PERSONAL	101,073	96,965	0	3,662	0	0	446	0
AERIAL	9,628	0	8,706	314	0	0	608	0
INSTRUCTIONAL	11,281	10,475	0	610	0	0	196	0
AIR TAXI	8,978	2,932	0	4,251	487	190	328	789
OTHER	26,632	21,679	0	2,592	141	304	1,277	640

TABLE A-1. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	253,740	198,395	8,910	34,923	2,923	3,051	3,609	1,929
BUSINESS	78,999	61,556	0	16,787	0	0	656	0
CORPORATE	13,968	1,926	0	6,695	2,316	2,542	0	490
PERSONAL	103,472	99,282	0	3,729	0	0	462	0
AERIAL	9,857	0	8,910	319	0	0	627	0
INSTRUCTIONAL	10,654	9,885	0	576	0	0	193	0
AIR TAXI	8,608	2,812	0	4,076	467	183	315	756
OTHER	28,182	22,934	0	2,742	141	326	1,357	683

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	264,453	206,429	9,113	36,918	3,020	3,235	3,739	2,000
BUSINESS	85,998	67,056	0	18,263	0	0	679	0
CORPORATE	14,613	2,002	0	6,991	2,405	2,705	0	511
PERSONAL	105,352	101,107	0	3,777	0	0	478	0
AERIAL	10,083	0	9,113	325	0	0	645	0
INSTRUCTIONAL	9,992	9,263	0	540	0	0	189	0
AIR TAXI	8,736	2,854	0	4,136	474	185	319	768
OTHER	29,669	24,147	0	2,386	141	345	1,428	721

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	279,080	217,665	9,289	39,389	3,193	3,479	3,961	2,105
BUSINESS	95,906	75,014	0	20,166	0	0	726	0
CORPORATE	15,628	2,154	0	7,418	2,589	2,913	0	554
PERSONAL	108,267	103,855	0	3,910	0	0	502	0
AERIAL	10,280	0	9,289	329	0	0	662	0
INSTRUCTIONAL	9,423	8,729	0	509	0	0	186	0
AIR TAXI	8,559	2,796	0	4,053	464	181	313	752
OTHER	31,017	25,117	0	3,003	141	385	1,572	799

TABLE A-2.

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	32,752	21,659	1,820	5,768	1,235	803	715	752
BUSINESS	5,869	4,160	0	1,640	0	0	69	0
CORPORATE	3,183	294	0	1,480	677	590	0	142
PERSONAL	8,244	7,830	0	404	0	0	10	0
AERIAL	1,940	0	1,820	23	0	0	97	0
INSTRUCTIONAL	5,433	5,180	0	161	0	0	92	0
AIR TAXI	3,590	775	0	1,720	460	74	91	470
OTHER	4,493	3,420	0	340	98	139	356	140

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	31,093	20,799	1,888	5,357	1,185	670	644	549
BUSINESS	5,426	3,802	0	1,542	0	0	82	0
CORPORATE	3,007	236	0	1,492	607	571	0	101
PERSONAL	8,047	7,572	0	366	0	0	10	0
AERIAL	2,073	0	1,888	44	0	0	141	0
INSTRUCTIONAL	4,983	4,787	0	148	0	0	48	0
AIR TAXI	3,439	929	0	1,445	516	69	138	344
OTHER	4,118	3,374	0	321	61	30	227	105

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	34,163	22,705	2,005	5,893	1,390	768	747	655
BUSINESS	5,922	4,191	0	1,646	0	0	84	0
CORPORATE	3,303	266	0	1,559	722	646	0	110
PERSONAL	8,624	8,214	0	400	0	0	10	0
AERIAL	2,201	0	2,005	46	0	0	150	0
INSTRUCTIONAL	4,973	4,777	0	148	0	0	49	0
AIR TAXI	4,040	1,091	0	1,697	606	81	152	404
OTHER	5,099	4,167	0	397	61	42	292	140

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	37,081	24,594	2,115	6,377	1,556	916	815	709
BUSINESS	6,709	4,803	0	1,819	0	0	88	0
CORPORATE	3,734	289	0	1,666	855	779	0	116
PERSONAL	9,144	8,697	0	436	0	0	11	0
AERIAL	2,321	0	2,115	49	0	0	158	0
INSTRUCTIONAL	4,944	4,749	0	147	0	0	49	0
AIR TAXI	4,259	1,153	0	1,793	640	85	171	427
OTHER	5,989	4,904	0	467	61	51	339	166

TABLE A-2. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
1979								
TOTAL	39,276	26,093	2,216	6,742	1,629	1,037	840	720
BUSINESS	7,475	5,376	0	2,010	0	0	89	0
CORPORATE	3,994	298	0	1,757	926	896	0	117
PERSONAL	9,570	9,098	0	460	0	0	11	0
AERIAL	2,432	0	2,216	51	0	0	165	0
INSTRUCTIONAL	4,873	4,680	0	145	0	0	48	0
AIR TAXI	4,276	1,154	0	1,796	641	86	171	428
OTHER	6,656	5,486	0	523	61	56	355	175
1980								
TOTAL	41,328	27,425	2,309	7,073	1,732	1,185	873	732
BUSINESS	8,250	5,952	0	2,208	0	0	90	0
CORPORATE	4,340	310	0	1,839	1,034	1,039	0	119
PERSONAL	9,930	9,439	0	480	0	0	12	0
AERIAL	2,535	0	2,309	53	0	0	172	0
INSTRUCTIONAL	4,793	4,602	0	142	0	0	48	0
AIR TAXI	4,244	1,146	0	1,782	637	85	170	424
OTHER	7,225	5,965	0	568	61	51	380	189
1981								
TOTAL	43,449	28,808	2,395	7,417	1,845	1,345	898	742
BUSINESS	9,059	6,558	0	2,410	0	0	91	0
CORPORATE	4,695	321	0	1,911	1,150	1,193	0	120
PERSONAL	10,335	9,818	0	505	0	0	12	0
AERIAL	2,629	0	2,395	55	0	0	179	0
INSTRUCTIONAL	4,593	4,409	0	136	0	0	48	0
AIR TAXI	4,224	1,140	0	1,774	534	84	169	422
OTHER	7,913	6,561	0	625	61	67	399	200
1982								
TOTAL	44,999	29,751	2,473	7,555	1,952	1,526	909	732
BUSINESS	9,846	7,142	0	2,514	0	0	90	0
CORPORATE	5,031	330	0	1,976	1,282	1,373	0	120
PERSONAL	10,614	10,084	0	516	0	0	13	0
AERIAL	2,715	0	2,473	57	0	0	185	0
INSTRUCTIONAL	4,336	4,161	0	129	0	0	47	0
AIR TAXI	4,032	1,094	0	1,702	608	81	162	405
OTHER	8,355	5,940	0	661	61	72	413	207

TABLE A-2. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	46,649	30,703	2,544	7,983	2,063	1,680	930	746
BUSINESS	10,632	7,724	0	2,618	0	0	89	0
CORPORATE	5,401	339	0	2,037	1,385	1,520	0	120
PERSONAL	10,964	10,325	0	526	0	0	13	0
AERIAL	2,793	0	2,544	59	0	0	190	0
INSTRUCTIONAL	4,066	3,899	0	121	0	0	46	0
AIR TAXI	4,111	1,110	0	1,726	617	82	164	411
OTHER	8,783	7,305	0	696	61	77	427	216

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	48,090	31,520	2,608	8,240	2,173	1,857	944	746
BUSINESS	11,339	8,290	0	3,021	0	0	89	0
CORPORATE	5,765	347	0	2,096	1,507	1,695	0	120
PERSONAL	11,062	10,515	0	533	0	0	14	0
AERIAL	2,863	0	2,608	60	0	0	195	0
INSTRUCTIONAL	3,835	3,676	0	114	0	0	45	0
AIR TAXI	4,030	1,088	0	1,692	604	81	161	403
OTHER	9,136	7,604	0	725	61	82	441	223

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	50,710	33,109	2,667	8,688	2,388	2,086	990	783
BUSINESS	12,392	9,049	0	3,255	0	0	89	0
CORPORATE	6,265	365	0	2,170	1,698	1,911	0	121
PERSONAL	11,367	10,801	0	551	0	0	15	0
AERIAL	2,927	0	2,667	61	0	0	199	0
INSTRUCTIONAL	3,748	3,593	0	111	0	0	44	0
AIR TAXI	4,192	1,132	0	1,761	629	84	168	419
OTHER	9,819	8,170	0	778	61	91	476	243

TABLE A-3.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	18.837	24.666	49.030	41.322	2.971	130.885
1977	19.795	27.132	51.593	45.875	3.285	141.110
1978	20.751	29.804	54.143	50.855	3.609	151.943
1979	21.465	31.904	56.070	54.777	3.854	160.363
1980	22.082	34.045	57.730	58.842	4.105	168.594
1981	22.580	36.256	59.106	63.091	4.367	176.666
1982	22.784	38.186	59.711	66.918	4.593	183.004
1983	22.932	40.168	60.172	70.881	4.841	189.312
1984	23.071	42.030	60.596	74.612	5.068	195.240
1985	23.725	44.905	62.359	80.179	5.427	205.742

TABLE A-4.

PILOT DATA, 1975 TO 1985

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
STUDENT PILOTS	180,800	173,251	173,746	171,663	168,747	165,433	159,237	151,942	144,812	138,096	131,370
PRIVATE PILOTS	305,900	321,414	333,071	344,538	355,130	364,632	373,948	382,394	389,685	395,611	399,183
COMMERCIAL PILOTS	192,500	198,319	204,586	210,350	215,336	219,716	222,575	223,892	223,778	222,628	221,680
PILOT SUBTOTAL	679,200	692,985	711,503	726,551	739,213	749,781	755,761	758,228	758,275	756,335	752,234
HELICOPTER PILOTS	5,647	5,243	4,960	4,666	4,376	4,107	3,802	3,488	3,185	2,914	2,672
TOTAL PILOTS	684,847	698,228	716,464	731,217	743,590	753,888	759,563	761,715	761,459	759,250	754,906
INSTRUMENT RATINGS	199,300	211,543	224,391	236,540	248,005	258,836	268,098	275,750	281,878	286,847	291,866
HELICOPTER RATINGS	22,971	24,178	25,398	26,635	27,881	29,126	30,365	31,578	32,749	33,863	34,909
TOTAL HELIC RATINGS	28,618	29,421	30,358	31,301	32,257	33,233	34,167	35,066	35,934	36,777	37,581

TABLE A-5.

FUEL CONSUMED (MILLION GALLONS) DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	AV GAS	JET FUEL
1976	776	462	314
1977	868	506	363
1978	971	547	424
1979	1,049	579	470
1980	1,134	607	526
1981	1,224	637	587
1982	1,312	657	655
1983	1,395	681	714
1984	1,481	700	780
1985	1,607	736	872

TABLE A-6.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1976	48,261,497
1977	53,555,921
1978	60,500,239
1979	65,776,077
1980	71,563,201
1981	77,899,685
1982	84,395,390
1983	90,277,770
1984	96,521,539
1985	105,297,608

SECTION A.2. ULLMAN BILL

TABLE A-7.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	158,950	126,152	5,712	19,787	2,120	1,579	2,346	1,264
BUSINESS	34,138	26,012	0	7,733	0	0	393	0
CORPORATE	8,787	1,284	0	4,253	1,636	1,279	0	335
PERSONAL	76,957	73,878	0	2,732	0	0	347	0
AERIAL	6,437	0	5,712	260	0	0	465	0
INSTRUCTIONAL	12,648	11,799	0	636	0	0	213	0
AIR TAXI	6,227	2,134	0	2,842	338	168	192	553
OTHER	13,766	11,045	0	1,331	146	132	736	376

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	161,458	126,506	6,602	21,103	1,876	1,594	2,236	1,441
BUSINESS	34,373	26,075	0	7,903	0	0	396	0
CORPORATE	8,325	1,151	0	4,219	1,384	1,300	0	271
PERSONAL	76,687	73,765	0	2,593	0	0	329	0
AERIAL	7,058	0	6,602	129	0	0	327	0
INSTRUCTIONAL	13,409	12,308	0	721	0	0	380	0
AIR TAXI	7,689	1,989	0	4,126	352	157	176	880
OTHER	13,916	11,318	0	1,412	141	127	629	290

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	171,374	134,81[illegible]	6,958	21,781	2,150	1,773	2,546	1,352
BUSINESS	38,780	29,637	0	8,698	0	0	445	0
CORPORATE	9,266	1,338	0	4,546	1,615	1,443	0	324
PERSONAL	82,171	78,985	0	2,836	0	0	350	0
AERIAL	7,691	0	6,958	255	0	0	479	0
INSTRUCTIONAL	12,223	11,364	0	652	0	0	197	0
AIR TAXI	7,236	2,384	0	3,455	394	155	267	641
OTHER	13,947	11,106	0	1,329	141	176	808	387

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	188,958	148,021	7,390	24,646	2,413	2,046	2,859	1,592
BUSINESS	45,407	34,997	0	9,908	0	0	503	0
CORPORATE	10,330	1,499	0	5,006	1,808	1,648	0	369
PERSONAL	87,093	83,625	0	3,095	0	0	373	0
AERIAL	8,169	0	7,390	270	0	0	508	0
INSTRUCTIONAL	12,228	11,364	0	662	0	0	201	0
AIR TAXI	8,580	2,803	0	4,063	465	182	313	754
OTHER	17,161	13,733	0	1,643	141	217	960	469

TABLE A-7. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	201,208	157,282	7,794	26,711	2,523	2,256	2,953	1,689
BUSINESS	51,377	39,767	0	11,111	0	0	499	0
CORPORATE	11,039	1,569	0	5,361	1,890	1,829	0	389
PERSONAL	91,048	87,481	0	3,181	0	0	386	0
AERIAL	8,615	0	7,794	285	0	0	536	0
INSTRUCTIONAL	10,039	9,320	0	543	0	0	176	0
AIR TAXI	9,070	2,963	0	4,295	492	192	331	797
OTHER	20,019	16,183	0	1,935	141	234	1,023	503

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	211,556	164,823	8,193	28,571	2,636	2,453	3,106	1,764
BUSINESS	57,356	44,493	0	12,345	0	0	528	0
CORPORATE	11,801	1,662	0	5,709	2,003	2,012	0	415
PERSONAL	93,016	89,349	0	3,268	0	0	399	0
AERIAL	9,055	0	8,193	300	0	0	562	0
INSTRUCTIONAL	8,875	8,223	0	479	0	0	173	0
AIR TAXI	9,086	2,968	0	4,302	493	193	332	798
OTHER	22,357	18,128	0	2,167	141	258	1,112	550

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	221,590	172,219	8,478	30,374	2,748	2,671	3,266	1,834
BUSINESS	63,443	49,275	0	13,607	0	0	561	0
CORPORATE	12,574	1,759	0	6,059	2,118	2,196	0	443
PERSONAL	95,028	91,230	0	3,382	0	0	416	0
AERIAL	9,373	0	8,478	309	0	0	586	0
INSTRUCTIONAL	8,481	7,852	0	458	0	0	171	0
AIR TAXI	9,017	2,946	0	4,270	489	191	329	792
OTHER	23,673	19,158	0	2,290	141	283	1,202	599

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	230,550	178,777	8,706	32,071	2,842	2,865	3,393	1,895
BUSINESS	69,209	53,795	0	14,331	0	0	583	0
CORPORATE	13,274	1,841	0	6,382	2,214	2,371	0	466
PERSONAL	95,891	92,062	0	3,401	0	0	428	0
AERIAL	9,628	0	8,706	314	0	0	608	0
INSTRUCTIONAL	8,334	7,716	0	450	0	0	168	0
AIR TAXI	8,978	2,932	0	4,251	487	190	328	789
OTHER	25,237	20,430	0	2,442	141	304	1,279	641

TABLE A-7. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	238,149	184,327	8,910	33,498	2,923	3,051	3,510	1,930
BUSINESS	74,949	58,299	0	16,046	0	0	604	0
CORPORATE	13,972	1,926	0	6,698	2,316	2,542	0	490
PERSONAL	96,616	92,764	0	3,411	0	0	441	0
AERIAL	9,857	0	8,910	319	0	0	627	0
INSTRUCTIONAL	8,150	7,546	0	440	0	0	164	0
AIR TAXI	8,608	2,812	0	4,076	467	183	315	756
OTHER	25,998	20,981	0	2,508	141	326	1,359	684

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	245,536	189,455	9,113	35,079	3,020	3,235	3,633	2,001
BUSINESS	80,410	62,574	0	17,212	0	0	623	0
CORPORATE	14,617	2,002	0	6,994	2,405	2,715	0	511
PERSONAL	97,038	93,144	0	3,410	0	0	454	0
AERIAL	10,083	0	9,113	325	0	0	645	0
INSTRUCTIONAL	7,946	7,356	0	429	0	0	161	0
AIR TAXI	8,736	2,854	0	4,136	474	185	319	768
OTHER	26,736	21,525	0	2,573	141	345	1,430	722

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	256,685	197,685	9,289	37,085	3,193	3,479	3,848	2,106
BUSINESS	88,480	69,064	0	18,751	0	0	665	0
CORPORATE	15,632	2,154	0	7,422	2,589	2,913	0	554
PERSONAL	98,529	94,562	0	3,492	0	0	475	0
AERIAL	10,280	0	9,289	329	0	0	662	0
INSTRUCTIONAL	7,799	7,219	0	421	0	0	159	0
AIR TAXI	8,559	2,796	0	4,053	464	181	313	752
OTHER	27,406	21,890	0	2,617	141	385	1,574	800

TABLE A-8.

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	32,752	21,659	1,820	5,768	1,235	803	715	752
BUSINESS	5,869	4,160	0	1,640	0	0	69	0
CORPORATE	3,183	294	0	1,480	677	590	0	142
PERSONAL	8,244	7,830	0	404	0	0	10	0
AERIAL	1,940	0	1,820	23	0	0	97	0
INSTRUCTIONAL	5,433	5,180	0	161	0	0	92	0
AIR TAXI	3,590	775	0	1,720	460	74	91	470
OTHER	4,493	3,420	0	340	98	139	356	140

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	31,093	20,799	1,888	5,357	1,185	670	644	549
BUSINESS	5,426	3,802	0	1,542	0	0	82	0
CORPORATE	3,007	236	0	1,492	607	571	0	101
PERSONAL	8,047	7,672	0	366	0	0	10	0
AERIAL	2,073	0	1,888	44	0	0	141	0
INSTRUCTIONAL	4,983	4,787	0	148	0	0	48	0
AIR TAXI	3,439	929	0	1,445	516	59	138	344
OTHER	4,113	3,374	0	321	61	30	227	105

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	34,153	22,705	2,005	5,893	1,390	758	747	655
BUSINESS	5,922	4,191	0	1,646	0	0	84	0
CORPORATE	3,303	266	0	1,559	722	646	0	110
PERSONAL	8,624	8,214	0	400	0	0	10	0
AERIAL	2,201	0	2,005	46	0	0	150	0
INSTRUCTIONAL	4,973	4,777	0	148	0	0	49	0
AIR TAXI	4,040	1,091	0	1,697	606	81	162	404
OTHER	5,099	4,167	0	397	61	42	292	140

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	35,808	23,559	2,115	6,207	1,556	916	766	691
BUSINESS	6,433	4,508	0	1,744	0	0	81	0
CORPORATE	3,617	277	0	1,597	855	779	0	110
PERSONAL	9,144	8,697	0	436	0	0	11	0
AERIAL	2,321	0	2,115	49	0	0	158	0
INSTRUCTIONAL	4,084	3,920	0	121	0	0	43	0
AIR TAXI	4,269	1,153	0	1,793	640	85	171	427
OTHER	5,939	4,904	0	467	61	51	302	154

TABLE A-8. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	37,572	24,657	2,216	6,544	1,629	1,037	786	732
BUSINESS	7,178	5,170	0	1,930	0	0	78	0
CORPORATE	3,909	286	0	1,689	926	896	0	112
PERSONAL	9,558	9,098	0	449	0	0	11	0
AERIAL	2,432	0	2,216	51	0	0	165	0
INSTRUCTIONAL	3,611	3,462	0	107	0	0	42	0
AIR TAXI	4,276	1,154	0	1,796	641	86	171	428
OTHER	6,607	5,486	0	523	61	56	318	163

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	39,132	25,540	2,309	6,834	1,732	1,185	817	715
BUSINESS	7,888	5,597	0	2,112	0	0	79	0
CORPORATE	4,256	299	0	1,771	1,034	1,039	0	114
PERSONAL	9,755	9,292	0	461	0	0	12	0
AERIAL	2,535	0	2,309	53	0	0	172	0
INSTRUCTIONAL	3,451	3,307	0	102	0	0	42	0
AIR TAXI	4,244	1,146	0	1,782	637	85	170	424
OTHER	6,933	5,799	0	553	61	51	343	177

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	40,838	26,561	2,395	7,125	1,845	1,345	843	725
BUSINESS	8,558	6,194	0	2,285	0	0	79	0
CORPORATE	4,613	310	0	1,544	1,150	1,193	0	115
PERSONAL	9,977	9,488	0	477	0	0	12	0
AERIAL	2,629	0	2,395	55	0	0	179	0
INSTRUCTIONAL	3,391	3,250	0	101	0	0	41	0
AIR TAXI	4,224	1,140	0	1,774	634	84	169	422
OTHER	7,447	6,179	0	589	61	57	363	188

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	41,987	27,163	2,473	7,302	1,952	1,526	855	717
BUSINESS	9,181	6,652	0	2,450	0	0	79	0
CORPORATE	5,001	320	0	1,911	1,282	1,373	0	115
PERSONAL	10,066	9,574	0	480	0	0	12	0
AERIAL	2,715	0	2,473	57	0	0	185	0
INSTRUCTIONAL	3,316	3,178	0	98	0	0	40	0
AIR TAXI	4,052	1,094	0	1,702	608	81	162	405
OTHER	7,656	6,345	0	605	61	72	377	196

TABLE A-8. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	43,245	27,787	2,544	7,563	2,063	1,680	876	732
BUSINESS	9,780	7,094	0	2,608	0	0	78	0
CORPORATE	5,323	329	0	1,973	1,385	1,520	0	116
PERSONAL	10,141	9,547	0	481	0	0	13	0
AERIAL	2,793	0	2,544	59	0	0	190	0
INSTRUCTIONAL	3,233	3,098	0	96	0	0	39	0
AIR TAXI	4,111	1,110	0	1,726	617	82	164	411
OTHER	7,864	6,509	0	620	61	77	392	205

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	44,305	28,291	2,608	7,752	2,173	1,857	892	732
BUSINESS	10,351	7,513	0	2,760	0	0	77	0
CORPORATE	5,689	337	0	2,033	1,507	1,695	0	116
PERSONAL	10,181	9,687	0	481	0	0	13	0
AERIAL	2,853	0	2,608	60	0	0	195	0
INSTRUCTIONAL	3,173	3,040	0	94	0	0	39	0
AIR TAXI	4,030	1,088	0	1,692	604	81	161	403
OTHER	8,018	5,525	0	631	61	82	407	213

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	46,386	29,419	2,667	8,120	2,388	2,086	937	769
BUSINESS	11,119	8,104	0	2,938	0	0	77	0
CORPORATE	6,189	355	0	2,108	1,698	1,911	0	118
PERSONAL	10,341	9,834	0	492	0	0	14	0
AERIAL	2,927	0	2,667	61	0	0	199	0
INSTRUCTIONAL	3,119	2,988	0	92	0	0	38	0
AIR TAXI	4,192	1,132	0	1,761	629	84	168	419
OTHER	8,499	7,006	0	668	61	91	441	232

TABLE A-9.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	18,837	24,666	49,030	41,322	2,971	130,885
1977	19,796	27,132	51,593	45,875	3,285	141,110
1978	19,214	28,928	50,255	49,731	3,523	144,605
1979	19,225	30,805	50,403	53,505	3,753	150,186
1980	19,490	32,630	51,146	57,103	3,972	156,397
1981	19,938	34,493	52,353	60,695	4,194	163,284
1982	20,156	36,037	52,952	63,757	4,375	168,526
1983	20,339	37,612	53,457	66,902	4,575	173,734
1984	20,502	39,063	53,905	69,807	4,754	178,523
1985	20,948	41,430	55,103	74,452	5,055	186,878

TABLE A-10.

PILOT DATA, 1975 TO 1985

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
STUDENT PILOTS	180,800	173,251	173,746	139,932	128,133	123,529	118,350	113,081	109,553	106,589	103,517
PRIVATE PILOTS	305,900	321,414	333,071	351,829	359,697	363,652	366,001	365,730	365,950	364,271	361,925
COMMERCIAL PILOTS	192,500	198,319	204,686	203,060	201,973	201,132	200,429	199,818	199,254	198,697	198,126
PILOT SUBTOTAL	679,200	692,985	711,503	694,821	689,809	688,313	684,790	679,629	674,757	669,558	663,569
HELICOPTER PILOTS	5,647	5,243	4,960	4,236	3,687	3,272	2,919	2,614	2,353	2,137	1,956
TOTAL PILOTS	684,847	698,228	716,464	699,057	693,496	691,585	687,709	682,243	677,110	671,695	665,524
INSTRUMENT RATINGS	199,300	211,543	224,391	229,250	234,670	240,201	245,683	251,055	256,258	261,237	265,965
HELICOPTER RATINGS	22,971	24,178	25,398	26,635	27,733	28,883	29,910	30,879	31,795	32,660	33,477
TOTAL HELIC RATINGS	28,618	29,421	30,358	30,871	31,480	32,155	32,829	33,494	34,148	34,797	35,432

TABLE A-11.

FUEL CONSUMED (MILLION GALLONS) DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	AV GAS	JET FUEL
1976	776	462	314
1977	869	506	363
1978	952	528	424
1979	1,024	554	469
1980	1,102	576	526
1981	1,186	600	587
1982	1,268	614	654
1983	1,345	631	713
1984	1,425	645	780
1985	1,543	672	871

TABLE A-12.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1976	48,261,497
1977	53,555,921
1978	278,807,635
1979	300,291,725
1980	323,703,613
1981	349,082,650
1982	373,988,338
1983	397,021,476
1984	421,258,667
1985	456,818,116

SECTION A.3. BASELINE/*ULLMAN* BILL COMPARISON

TABLE A-13.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1975

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1976

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1977

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1978

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.01	0.00	0.02	0.00	0.00	0.03	0.00
CORPORATE	0.02	0.00	0.04	0.00	0.00	0.00	0.04
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.22	0.00	0.12	0.00	0.00	0.09	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.23	0.16

TABLE A-13. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1979

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.02	0.00	0.03	0.00	0.00	-5.84	0.00
CORPORATE	0.02	0.00	0.05	0.00	0.00	0.00	0.04
PERSONAL	0.00	0.00	-2.54	0.00	0.00	-1.38	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-17.35	0.00	-17.40	0.00	0.00	-12.01	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.24	0.16

1980

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-0.84	0.00	-0.59	0.00	0.00	-6.60	0.00
CORPORATE	0.02	0.00	0.06	0.00	0.00	0.00	0.03
PERSONAL	-1.55	0.00	-3.93	0.00	0.00	-2.41	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-26.00	0.00	-26.01	0.00	0.00	-13.17	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.06	0.00	0.05	0.00	0.00	0.22	0.14

1981

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-2.23	0.00	-1.70	0.00	0.00	-7.20	0.00
CORPORATE	0.02	0.00	0.06	0.00	0.00	0.00	0.03
PERSONAL	-3.36	0.00	-5.59	0.00	0.00	-3.25	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-28.16	0.00	-28.15	0.00	0.00	-14.11	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-2.72	0.00	-2.74	0.00	0.00	0.20	0.13

1982

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-3.77	0.00	-3.02	0.00	0.00	-7.61	0.00
CORPORATE	0.02	0.00	0.06	0.00	0.00	0.00	0.03
PERSONAL	-5.06	0.00	-7.14	0.00	0.00	-3.92	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-26.34	0.00	-26.32	0.00	0.00	-14.54	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-5.76	0.00	-5.77	0.00	0.00	0.18	0.12

TABLE A-13. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1983

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-5.29	0.00	-4.41	0.00	0.00	-7.96	0.00
CORPORATE	0.02	0.00	0.05	0.00	0.00	0.00	0.02
PERSONAL	-6.56	0.00	-8.52	0.00	0.00	-4.48	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-23.67	0.00	-23.65	0.00	0.00	-14.75	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-8.52	0.00	-8.53	0.00	0.00	0.17	0.10

1984

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-6.68	0.00	-5.75	0.00	0.00	-8.26	0.00
CORPORATE	0.01	0.00	0.05	0.00	0.00	0.00	0.02
PERSONAL	-7.88	0.00	-9.72	0.00	0.00	-4.97	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-20.58	0.00	-20.56	0.00	0.00	-14.69	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-10.86	0.00	-10.87	0.00	0.00	0.16	0.10

1985

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-7.93	0.00	-7.02	0.00	0.00	-8.50	0.00
CORPORATE	0.01	0.00	0.05	0.00	0.00	0.00	0.02
PERSONAL	-8.95	0.00	-10.70	0.00	0.00	-5.38	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-17.30	0.00	-17.30	0.00	0.00	-14.35	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-12.85	0.00	-12.86	0.00	0.00	0.14	0.08

TABLE A-14.

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1975

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1976

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1977

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1978

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-4.06	0.00	-4.15	0.00	0.00	-7.03	0.00
CORPORATE	-4.05	0.00	-4.14	0.00	0.00	0.00	-4.80
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-17.45	0.00	-17.45	0.00	0.00	-12.02	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	-10.94	-7.54

TABLE A-14. (Cont.)

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1979

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-3.84	0.00	-3.94	0.00	0.00	-12.14	0.00
CORPORATE	-3.84	0.00	-3.92	0.00	0.00	0.00	-4.46
PERSONAL	0.00	0.00	-2.54	0.00	0.00	-1.38	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-26.03	0.00	-26.03	0.00	0.00	-13.17	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	-10.35	-7.01

1980

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-4.45	0.00	-4.34	0.00	0.00	-12.49	0.00
CORPORATE	-3.62	0.00	-3.71	0.00	0.00	0.00	-4.13
PERSONAL	-1.55	0.00	-3.93	0.00	0.00	-2.41	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-28.14	0.00	-28.14	0.00	0.00	-14.11	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-2.79	0.00	-2.79	0.00	0.00	-9.78	-6.49

1981

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-5.55	0.00	-5.18	0.00	0.00	-12.66	0.00
CORPORATE	-3.38	0.00	-3.49	0.00	0.00	0.00	-3.76
PERSONAL	-3.36	0.00	-5.59	0.00	0.00	-3.25	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-26.30	0.00	-26.30	0.00	0.00	-14.54	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-5.82	0.00	-5.82	0.00	0.00	-9.14	-5.91

1982

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-6.86	0.00	-6.29	0.00	0.00	-12.73	0.00
CORPORATE	-3.19	0.00	-3.31	0.00	0.00	0.00	-3.46
PERSONAL	-5.06	0.00	-7.14	0.00	0.00	-3.92	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-23.63	0.00	-23.63	0.00	0.00	-14.75	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-8.57	0.00	-8.57	0.00	0.00	-8.63	-5.45

TABLE A-14. (Cont.)

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1983

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-8.16	0.00	-7.47	0.00	0.00	-12.79	0.00
CORPORATE	-3.01	0.00	-3.15	0.00	0.00	0.00	-3.19
PERSONAL	-6.56	0.00	-8.52	0.00	0.00	-4.48	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-20.54	0.00	-20.54	0.00	0.00	-14.69	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-10.90	0.00	-10.90	0.00	0.00	-8.17	-5.03

1984

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-9.36	0.00	-8.63	0.00	0.00	-12.82	0.00
CORPORATE	-2.86	0.00	-3.01	0.00	0.00	0.00	-2.95
PERSONAL	-7.88	0.00	-9.72	0.00	0.00	-4.97	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-17.29	0.00	-17.29	0.00	0.00	-14.35	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-12.88	0.00	-12.88	0.00	0.00	-7.75	-4.66

1985

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	-10.44	0.00	-9.73	0.00	0.00	-12.82	0.00
CORPORATE	-2.71	0.00	-2.87	0.00	0.00	0.00	-2.73
PERSONAL	-8.95	0.00	-10.70	0.00	0.00	-5.38	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	-16.84	0.00	-16.84	0.00	0.00	-13.75	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	-14.24	0.00	-14.24	0.00	0.00	-7.37	-4.31

TABLE A-15.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	-7.41	-2.94	-7.18	-2.21	-2.37	-4.83
1979	-10.44	-3.45	-10.11	-2.32	-2.63	-6.35
1980	-11.74	-4.16	-11.40	-2.95	-3.23	-7.23
1981	-11.70	-4.86	-11.43	-3.80	-3.94	-7.58
1982	-11.53	-5.63	-11.32	-4.72	-4.73	-7.91
1983	-11.31	-6.36	-11.16	-5.61	-5.43	-8.23
1984	-11.13	-7.06	-11.04	-6.44	-6.21	-8.56
1985	-11.71	-7.74	-11.64	-7.14	-6.85	-9.17

TABLE A-16.

PILOT DATA, % DEVIATION FROM BASELINE, 1975 TO 1985

	1975	1975	1977	1978	1979	1980	1981	1982	1983	1984	1985
STUDENT PILOTS	0.00	0.00	0.00	-18.48	-24.06	-25.33	-25.67	-25.58	-24.35	-22.81	-21.20
PRIVATE PILOTS	0.00	0.00	0.00	2.12	1.29	-0.27	-2.13	-4.10	-6.09	-7.92	-9.33
COMMERCIAL PILOTS	0.00	0.00	0.00	-3.47	-6.21	-8.46	-9.95	-10.75	-10.96	-10.75	-10.63
PILOT SUBTOTAL	0.00	0.00	0.00	-4.37	-6.68	-8.20	-9.39	-10.37	-11.01	-11.47	-11.79
HELICOPTER PILOTS	0.00	0.00	0.00	-9.21	-15.75	-20.33	-23.23	-25.04	-26.11	-26.66	-26.81
TOTAL PILOTS	0.00	0.00	0.00	-4.40	-6.74	-8.26	-9.46	-10.43	-11.08	-11.53	-11.84
INSTRUMENT RATINGS	0.00	0.00	0.00	-3.08	-5.33	-7.20	-8.36	-8.96	-9.09	-8.93	-8.87
HELICOPTER RATINGS	0.00	0.00	0.00	0.00	-0.31	-0.84	-1.50	-2.21	-2.91	-3.55	-4.10
TOTAL HELIC RATINGS	0.00	0.00	0.00	-1.37	-2.41	-3.25	-3.92	-4.48	-4.97	-5.38	-5.72

TABLE A-17.

FUEL CONSUMED DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

	AV GAS	JET FUEL
1976	0.00	0.00
1977	0.00	0.00
1978	-3.42	-0.11
1979	-4.23	-0.10
1980	-5.14	-0.08
1981	-5.86	-0.07
1982	-6.61	-0.06
1983	-7.28	-0.05
1984	-7.94	-0.05
1985	-8.66	-0.04

TABLE A-18.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1976	0.00
1977	0.00
1978	360.84
1979	356.54
1980	352.33
1981	348.12
1982	343.14
1983	339.78
1984	336.44
1985	333.84

APPENDIX B

CASE 2. LOW VERSUS HIGH ECONOMY

Section B.1. Low Economy

TABLE B-1.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	158,950	125,152	5,712	19,787	2,120	1,579	2,346	1,264
BUSINESS	34,138	25,012	0	7,733	0	0	393	0
CORPORATE	8,787	1,284	0	4,253	1,636	1,279	0	335
PERSONAL	76,957	73,878	0	2,732	0	0	347	0
AERIAL	6,437	0	5,712	260	0	0	465	0
INSTRUCTIONAL	12,648	11,799	0	636	0	0	213	0
AIR TAXI	6,227	2,134	0	2,842	338	158	192	553
OTHER	13,766	11,045	0	1,331	146	132	736	376

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	161,458	126,606	6,602	21,103	1,876	1,594	2,236	1,441
BUSINESS	34,373	26,075	0	7,903	0	0	396	0
CORPORATE	8,325	1,151	0	4,219	1,384	1,300	0	271
PERSONAL	76,687	73,765	0	2,593	0	0	329	0
AERIAL	7,058	0	6,602	129	0	0	327	0
INSTRUCTIONAL	13,409	12,308	0	721	0	0	380	0
AIR TAXI	7,589	1,989	0	4,126	352	167	176	880
OTHER	13,916	11,318	0	1,412	141	127	629	290

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	168,498	132,625	6,958	21,380	2,067	1,708	2,461	1,299
BUSINESS	37,414	28,500	0	8,483	0	0	431	0
CORPORATE	8,920	1,270	0	4,420	1,531	1,395	0	305
PERSONAL	81,102	77,985	0	2,772	0	0	344	0
AERIAL	7,691	0	6,958	255	0	0	479	0
INSTRUCTIONAL	12,223	11,364	0	662	0	0	197	0
AIR TAXI	7,301	2,385	0	3,458	395	155	267	641
OTHER	13,846	11,122	0	1,330	141	158	743	352

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	181,615	142,528	7,390	23,386	2,253	1,901	2,700	1,457
BUSINESS	42,252	32,389	0	9,384	0	0	479	0
CORPORATE	9,694	1,391	0	4,744	1,678	1,542	0	339
PERSONAL	85,098	81,763	0	2,973	0	0	362	0
AERIAL	8,169	0	7,390	270	0	0	508	0
INSTRUCTIONAL	12,202	11,340	0	661	0	0	201	0
AIR TAXI	8,016	2,619	0	3,796	434	170	293	704
OTHER	16,185	13,027	0	1,558	141	189	857	414

TABLE B-1. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	195,440	153,191	7,794	25,436	2,415	2,121	2,910	1,573
BUSINESS	49,491	37,406	0	10,567	0	0	519	0
CORPORATE	10,586	1,518	0	5,137	1,830	1,725	0	375
PERSONAL	89,009	85,496	0	3,133	0	0	380	0
AERIAL	8,615	0	7,794	285	0	0	536	0
INSTRUCTIONAL	12,133	11,275	0	657	0	0	230	0
AIR TAXI	8,203	2,680	0	3,884	444	174	330	721
OTHER	18,404	14,817	0	1,772	141	222	975	478

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	210,633	164,710	8,193	27,920	2,600	2,374	3,138	1,719
BUSINESS	55,982	43,412	0	12,008	0	0	562	0
CORPORATE	11,559	1,550	0	5,574	1,988	1,935	0	412
PERSONAL	92,758	89,069	0	3,290	0	0	398	0
AERIAL	9,055	0	8,193	300	0	0	562	0
INSTRUCTIONAL	11,960	11,112	0	648	0	0	230	0
AIR TAXI	9,693	2,837	0	4,112	471	194	317	763
OTHER	20,657	16,631	0	1,989	141	255	1,098	544

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	226,573	175,895	8,478	30,564	2,776	2,645	3,367	1,847
BUSINESS	64,696	50,386	0	13,699	0	0	611	0
CORPORATE	12,597	1,787	0	6,042	2,152	2,156	0	450
PERSONAL	96,326	92,456	0	3,452	0	0	418	0
AERIAL	9,373	0	8,478	309	0	0	586	0
INSTRUCTIONAL	11,757	10,930	0	637	0	0	200	0
AIR TAXI	8,918	2,913	0	4,223	483	189	326	783
OTHER	22,896	18,423	0	2,203	141	290	1,227	613

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	241,136	188,049	8,706	33,106	2,905	2,891	3,534	1,946
BUSINESS	73,121	57,070	0	15,409	0	0	642	0
CORPORATE	13,458	1,883	0	6,450	2,266	2,381	0	478
PERSONAL	99,432	95,435	0	3,560	0	0	436	0
AERIAL	9,628	0	8,706	314	0	0	608	0
INSTRUCTIONAL	11,281	10,475	0	610	0	0	196	0
AIR TAXI	9,184	3,000	0	4,348	498	195	336	807
OTHER	25,033	20,186	0	2,413	141	315	1,317	661

TABLE B-1. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	254,488	198,412	8,910	35,359	3,008	3,118	3,680	2,000
BUSINESS	81,640	63,808	0	17,162	0	0	670	0
CORPORATE	14,294	1,982	0	6,834	2,384	2,588	0	505
PERSONAL	102,181	98,078	0	3,648	0	0	455	0
AERIAL	9,857	0	8,910	319	0	0	627	0
INSTRUCTIONAL	10,654	9,885	0	576	0	0	193	0
AIR TAXI	8,912	2,911	0	4,220	483	189	326	783
OTHER	26,950	21,747	0	2,600	141	340	1,410	712

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	268,058	209,639	9,113	37,868	3,141	3,351	3,847	2,099
BUSINESS	90,430	70,761	0	18,968	0	0	701	0
CORPORATE	15,125	2,084	0	7,211	2,505	2,791	0	534
PERSONAL	104,545	100,346	0	3,727	0	0	473	0
AERIAL	10,083	0	9,113	325	0	0	645	0
INSTRUCTIONAL	9,992	9,263	0	540	0	0	189	0
AIR TAXI	9,132	2,983	0	4,324	495	194	334	802
OTHER	28,751	23,202	0	2,774	141	366	1,505	763

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	281,357	218,709	9,289	40,322	3,264	3,580	4,011	2,181
BUSINESS	99,598	78,024	0	20,838	0	0	736	0
CORPORATE	15,964	2,168	0	7,590	2,629	2,993	0	564
PERSONAL	106,551	102,256	0	3,804	0	0	491	0
AERIAL	10,280	0	9,289	329	0	0	662	0
INSTRUCTIONAL	9,423	8,729	0	509	0	0	186	0
AIR TAXI	9,124	2,980	0	4,320	495	193	333	802
OTHER	30,417	24,532	0	2,933	141	393	1,603	816

TABLE B-2.

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
1975								
TOTAL	32,752	21,659	1,820	5,768	1,235	803	715	752
BUSINESS	5,859	4,160	0	1,640	0	0	69	0
CORPORATE	3,183	294	0	1,480	677	590	0	142
PERSONAL	8,244	7,830	0	404	0	0	10	0
AERIAL	1,940	0	1,820	23	0	0	97	0
INSTRUCTIONAL	5,433	5,180	0	161	0	0	92	0
AIR TAXI	3,590	775	0	1,720	460	74	91	470
OTHER	4,493	3,420	0	340	98	139	356	140
1976								
TOTAL	31,093	20,799	1,888	5,357	1,185	670	644	549
BUSINESS	5,426	3,802	0	1,542	0	0	82	0
CORPORATE	3,007	236	0	1,492	607	571	0	101
PERSONAL	8,047	7,672	0	366	0	0	10	0
AERIAL	2,073	0	1,888	44	0	0	141	0
INSTRUCTIONAL	4,983	4,787	0	148	0	0	48	0
AIR TAXI	3,439	929	0	1,445	516	69	138	344
OTHER	4,118	3,374	0	321	61	30	227	105
1977								
TOTAL	33,267	22,185	2,005	5,702	1,312	737	712	612
BUSINESS	5,783	4,076	0	1,623	0	0	84	0
CORPORATE	3,204	255	0	1,533	685	624	0	107
PERSONAL	8,511	8,110	0	391	0	0	10	0
AERIAL	2,201	0	2,005	46	0	0	150	0
INSTRUCTIONAL	4,973	4,777	0	148	0	0	49	0
AIR TAXI	3,774	1,019	0	1,585	566	75	151	377
OTHER	4,820	3,949	0	376	61	37	268	128
1978								
TOTAL	35,408	23,579	2,115	6,023	1,434	851	763	645
BUSINESS	6,350	4,521	0	1,752	0	0	88	0
CORPORATE	3,512	273	0	1,606	793	729	0	111
PERSONAL	8,933	8,503	0	419	0	0	10	0
AERIAL	2,321	0	2,115	49	0	0	158	0
INSTRUCTIONAL	4,944	4,749	0	147	0	0	49	0
AIR TAXI	3,853	1,043	0	1,622	579	77	155	386
OTHER	5,475	4,490	0	428	61	45	303	147

TABLE B-2. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	37,833	25,101	2,216	6,459	1,571	979	816	691
BUSINESS	7,112	5,097	0	1,926	0	0	89	0
CORPORATE	3,845	290	0	1,698	897	845	0	115
PERSONAL	9,344	8,892	0	442	0	0	11	0
AERIAL	2,432	0	2,216	51	0	0	165	0
INSTRUCTIONAL	4,973	4,580	0	145	0	0	48	0
AIR TAXI	4,088	1,104	0	1,717	613	82	164	409
OTHER	6,138	5,038	0	480	61	53	339	167

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	40,321	26,656	2,309	6,893	1,718	1,143	867	725
BUSINESS	8,008	5,779	0	2,139	0	0	90	0
CORPORATE	4,252	308	0	1,800	1,026	999	0	119
PERSONAL	9,739	9,263	0	464	0	0	12	0
AERIAL	2,535	0	2,309	53	0	0	172	0
INSTRUCTIONAL	4,793	4,602	0	142	0	0	48	0
AIR TAXI	4,199	1,134	0	1,763	630	84	168	420
OTHER	6,797	5,580	0	532	61	51	376	187

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	42,781	28,158	2,395	7,350	1,879	1,332	910	757
BUSINESS	8,997	6,530	0	2,375	0	0	91	0
CORPORATE	4,690	325	0	1,899	1,169	1,176	0	120
PERSONAL	10,114	9,615	0	487	0	0	12	0
AERIAL	2,629	0	2,395	55	0	0	179	0
INSTRUCTIONAL	4,593	4,409	0	136	0	0	48	0
AIR TAXI	4,321	1,167	0	1,815	648	86	173	432
OTHER	7,436	6,111	0	582	61	59	408	204

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	44,753	29,385	2,473	7,682	2,003	1,537	928	755
BUSINESS	9,956	7,248	0	2,618	0	0	90	0
CORPORATE	5,134	336	0	1,987	1,312	1,379	0	121
PERSONAL	10,440	9,925	0	502	0	0	13	0
AERIAL	2,715	0	2,473	57	0	0	185	0
INSTRUCTIONAL	4,336	4,161	0	129	0	0	47	0
AIR TAXI	4,195	1,133	0	1,762	629	84	168	420
OTHER	7,986	6,583	0	627	61	75	425	214

TABLE B-3.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	18.837	24.666	49.030	41.322	2.971	130.385
1977	19.567	26.379	50.982	44.446	3.193	138.192
1978	20.294	28.341	52.926	48.085	3.413	146.234
1979	20.992	30.680	54.903	52.515	3.702	155.288
1980	21.701	33.248	56.714	57.412	4.013	165.062
1981	22.221	35.962	58.146	62.695	4.348	174.676
1982	22.556	38.339	59.102	67.372	4.631	182.737
1983	22.813	40.719	59.852	72.099	4.930	190.553
1984	23.093	43.109	60.654	76.843	5.225	198.474
1985	23.576	45.581	61.959	81.674	5.529	207.260

TABLE B-4.

FUEL CONSUMED (MILLION GALLONS) DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	AV GAS	JET FUEL
1976	775	462	314
1977	839	493	346
1978	915	522	393
1979	1,003	557	446
1980	1,103	592	511
1981	1,213	627	585
1982	1,316	654	662
1983	1,414	683	730
1984	1,520	710	809
1985	1,632	738	894

TABLE B-5.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1976	48,261,497
1977	51,778,597
1978	56,975,945
1979	62,819,957
1980	69,606,063
1981	77,229,547
1982	84,763,780
1983	91,643,037
1984	93,219,351
1985	107,171,205

SECTION B.2. HIGH ECONOMY

TABLE B-6.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	159,960	126,152	5,712	19,787	2,120	1,579	2,346	1,264
BUSINESS	34,138	26,012	0	7,733	0	0	393	0
CORPORATE	8,787	1,284	0	4,253	1,636	1,279	0	335
PERSONAL	76,957	73,878	0	2,732	0	0	347	0
AERIAL	6,437	0	5,712	260	0	0	465	0
INSTRUCTIONAL	12,648	11,799	0	636	0	0	213	0
AIR TAXI	6,227	2,134	0	2,842	338	168	192	553
OTHER	13,765	11,045	0	1,331	146	132	736	376

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	161,458	125,606	6,602	21,103	1,876	1,594	2,236	1,441
BUSINESS	34,373	26,075	0	7,903	0	0	396	0
CORPORATE	8,325	1,151	0	4,219	1,384	1,300	0	271
PERSONAL	76,687	73,765	0	2,593	0	0	329	0
AERIAL	7,058	0	6,602	129	0	0	327	0
INSTRUCTIONAL	13,409	12,308	0	721	0	0	380	0
AIR TAXI	7,689	1,989	0	4,126	352	157	176	880
OTHER	13,916	11,318	0	1,412	141	127	629	290

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	169,813	133,675	6,958	21,549	2,097	1,732	2,493	1,318
BUSINESS	37,899	28,903	0	8,559	0	0	436	0
CORPORATE	9,045	1,294	0	4,465	1,561	1,413	0	312
PERSONAL	81,777	78,517	0	2,812	0	0	348	0
AERIAL	7,691	0	6,958	255	0	0	479	0
INSTRUCTIONAL	12,223	11,364	0	662	0	0	197	0
AIR TAXI	7,299	2,385	0	3,457	395	155	267	641
OTHER	13,878	11,112	0	1,329	141	164	767	365

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	185,521	145,575	7,390	23,370	2,326	1,956	2,775	1,516
BUSINESS	43,655	33,551	0	9,614	0	0	490	0
CORPORATE	9,988	1,443	0	4,852	1,740	1,599	0	354
PERSONAL	86,520	83,090	0	3,060	0	0	370	0
AERIAL	8,159	0	7,390	270	0	0	508	0
INSTRUCTIONAL	12,202	11,340	0	661	0	0	201	0
AIR TAXI	8,219	2,685	0	3,892	445	174	300	722
OTHER	16,759	13,469	0	1,611	141	202	905	440

TABLE B-6. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	202,571	158,741	7,794	26,558	2,536	2,237	3,032	1,673
BUSINESS	51,266	39,694	0	11,034	0	0	537	0
CORPORATE	11,032	1,599	0	5,344	1,928	1,812	0	398
PERSONAL	91,245	87,582	0	3,271	0	0	392	0
AERIAL	8,615	0	7,794	285	0	0	536	0
INSTRUCTIONAL	12,133	11,275	0	657	0	0	200	0
AIR TAXI	8,616	2,815	0	4,080	467	183	315	757
OTHER	19,616	15,777	0	1,857	141	242	1,051	518

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	221,733	173,306	8,193	29,708	2,770	2,552	3,311	1,863
BUSINESS	60,636	47,240	0	12,807	0	0	589	0
CORPORATE	12,284	1,762	0	5,883	2,125	2,070	0	443
PERSONAL	95,877	91,977	0	3,484	0	0	416	0
AERIAL	9,055	0	8,193	300	0	0	562	0
INSTRUCTIONAL	11,960	11,112	0	648	0	0	200	0
AIR TAXI	9,318	3,044	0	4,413	505	198	340	819
OTHER	22,573	18,171	0	2,173	141	284	1,204	601

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	242,309	189,154	8,478	33,150	3,001	2,891	3,596	2,038
BUSINESS	71,831	56,245	0	14,938	0	0	648	0
CORPORATE	13,576	1,933	0	6,465	2,330	2,356	0	492
PERSONAL	100,391	95,242	0	3,708	0	0	441	0
AERIAL	9,373	0	8,478	309	0	0	586	0
INSTRUCTIONAL	11,767	10,930	0	637	0	0	200	0
AIR TAXI	9,776	3,194	0	4,629	530	207	357	859
OTHER	25,535	20,611	0	2,465	141	328	1,364	687

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	263,466	205,448	8,706	36,806	3,216	3,236	3,852	2,205
BUSINESS	84,177	66,156	0	17,326	0	0	695	0
CORPORATE	14,837	2,091	0	7,043	2,518	2,649	0	536
PERSONAL	104,643	100,287	0	3,889	0	0	467	0
AERIAL	9,628	0	8,706	314	0	0	608	0
INSTRUCTIONAL	11,281	10,475	0	610	0	0	196	0
AIR TAXI	10,271	3,355	0	4,863	557	218	375	902
OTHER	28,630	23,083	0	2,760	141	368	1,512	767

TABLE B-6. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE. DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	285.255	222.341	8.910	40,553	3.420	3,585	4.101	2.346
BUSINESS	97,380	77.240	0	19.997	0	0	743	0
CORPORATE	16.139	2.256	0	7.631	2.716	2,953	0	583
PERSONAL	108.586	104.041	0	4.053	0	0	492	0
AERIAL	9.857	0	8.910	319	0	0	627	0
INSTRUCTIONAL	10.654	9.885	0	576	0	0	193	0
AIR TAXI	10.338	3.397	0	4.924	563	221	380	914
OTHER	31.640	25.521	0	3.051	141	411	1.666	850

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	308.825	240.325	9.113	44.854	3.660	3.957	4.377	2.539
BUSINESS	113.413	89.651	0	22.969	0	0	793	0
CORPORATE	17.474	2.427	0	8.238	2.920	3.258	0	631
PERSONAL	112.188	107.459	0	4.211	0	0	519	0
AERIAL	10.083	0	9.113	325	0	0	645	0
INSTRUCTIONAL	9.992	9.263	0	540	0	0	189	0
AIR TAXI	11.056	3.612	0	5.235	599	234	404	971
OTHER	34.610	27.914	0	3.337	141	455	1.827	936

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	333.730	259.442	9.289	49.392	3.896	4.337	4.659	2.716
BUSINESS	130.694	103.576	0	26.267	0	0	851	0
CORPORATE	18.881	2.606	0	8.867	3.133	3.593	0	681
PERSONAL	115.457	110.541	0	4.370	0	0	546	0
AERIAL	10.280	0	9.289	329	0	0	662	0
INSTRUCTIONAL	9.423	8.729	0	509	0	0	186	0
AIR TAXI	11.475	3.749	0	5.434	622	243	419	1.008
OTHER	37.519	30.242	0	3.615	141	500	1.994	1.027

TABLE B-7.

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1975

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	32,752	21,659	1,820	5,768	1,235	803	715	752
BUSINESS	5,869	4,160	0	1,640	0	0	69	0
CORPORATE	3,183	294	0	1,480	677	590	0	142
PERSONAL	8,244	7,830	0	404	0	0	10	0
AERIAL	1,940	0	1,820	23	0	0	97	0
INSTRUCTIONAL	5,433	5,180	0	161	0	0	92	0
AIR TAXI	3,590	775	0	1,720	460	74	91	470
OTHER	4,493	3,420	0	340	98	139	356	140

1976

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	31,093	20,799	1,888	5,357	1,185	670	644	549
BUSINESS	5,426	3,802	0	1,542	0	0	82	0
CORPORATE	3,007	236	0	1,492	607	571	0	101
PERSONAL	8,047	7,672	0	366	0	0	10	0
AERIAL	2,073	0	1,888	44	0	0	141	0
INSTRUCTIONAL	4,983	4,787	0	148	0	0	48	0
AIR TAXI	3,439	929	0	1,445	516	69	138	344
OTHER	4,118	3,374	0	321	61	30	227	105

1977

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	33,684	22,459	2,005	5,779	1,340	748	725	628
BUSINESS	5,832	4,117	0	1,631	0	0	84	0
CORPORATE	3,240	259	0	1,543	698	632	0	108
PERSONAL	8,593	8,176	0	397	0	0	10	0
AERIAL	2,201	0	2,005	46	0	0	150	0
INSTRUCTIONAL	4,973	4,777	0	148	0	0	49	0
AIR TAXI	3,870	1,045	0	1,625	580	77	155	387
OTHER	4,985	4,086	0	389	61	39	277	132

1978

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	36,347	24,195	2,115	6,201	1,493	880	788	676
BUSINESS	6,513	4,645	0	1,781	0	0	88	0
CORPORATE	3,600	280	0	1,632	823	751	0	114
PERSONAL	9,034	8,641	0	431	0	0	11	0
AERIAL	2,321	0	2,115	49	0	0	158	0
INSTRUCTIONAL	4,944	4,749	0	147	0	0	49	0
AIR TAXI	4,058	1,096	0	1,704	609	81	162	406
OTHER	5,826	4,784	0	456	61	48	321	156

TABLE B-7. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1979

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	39.390	25.127	2,216	6.757	1,664	1.033	855	738
BUSINESS	7,419	5,343	0	1.987	0	0	89	0
CORPORATE	3,998	302	0	1.745	945	888	0	118
PERSONAL	9.581	9.108	0	461	0	0	11	0
AERIAL	2,432	0	2,216	51	0	0	165	0
INSTRUCTIONAL	4,873	4,580	0	145	0	0	48	0
AIR TAXI	4,388	1.185	0	1.843	658	98	176	439
OTHER	6,698	5.508	0	525	61	57	366	181

1980

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	42,591	28.168	2,309	7,329	1.849	1,228	920	789
BUSINESS	8,522	6.187	0	2.244	0	0	90	0
CORPORATE	4.481	324	0	1.859	1.097	1.059	0	122
PERSONAL	10.059	9.566	0	491	0	0	12	0
AERIAL	2,535	0	2,309	53	0	0	172	0
INSTRUCTIONAL	4,793	4.602	0	142	0	0	48	0
AIR TAXI	4.603	1.243	0	1.933	691	92	134	460
OTHER	7,588	6.246	0	595	61	67	412	206

1981

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	45.851	30.204	2.395	7.941	2.052	1.454	977	837
BUSINESS	9.772	7,143	0	2.538	0	0	91	0
CORPORATE	5.006	345	0	1.991	1.266	1.290	0	124
PERSONAL	10.545	10.009	0	523	0	0	13	0
AERIAL	2.629	0	2.395	55	0	0	179	0
INSTRUCTIONAL	4.593	4.409	0	136	0	0	48	0
AIR TAXI	4.834	1.305	0	2.030	725	97	193	483
OTHER	8.481	6.993	0	666	61	78	454	229

1982

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	49.006	32.176	2,473	8.500	2.254	1,720	1,020	863
BUSINESS	11.124	8,171	0	2.863	0	0	90	0
CORPORATE	5.590	363	0	2.110	1.458	1.534	0	125
PERSONAL	10.992	10.430	0	548	0	0	14	0
AERIAL	2,715	0	2,473	57	0	0	185	0
INSTRUCTIONAL	4,336	4.161	0	129	0	0	47	0
AIR TAXI	4.897	1,322	0	2,057	735	98	196	490
OTHER	9,351	7,729	0	737	61	87	488	248

TABLE B-7. (Cont.)

HOURS FLOWN (THOUSANDS) DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1983

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	52,389	34,242	2,544	9,183	2,466	1,957	1,072	915
BUSINESS	12,539	9,284	0	3,216	0	0	89	0
CORPORATE	6,121	381	0	2,225	1,624	1,756	0	126
PERSONAL	11,406	10,820	0	571	0	0	14	0
AERIAL	2,793	0	2,544	59	0	0	190	0
INSTRUCTIONAL	4,066	3,899	0	121	0	0	46	0
AIR TAXI	5,205	1,405	0	2,186	781	104	208	521
OTHER	10,209	8,452	0	805	61	97	525	268

1984

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	55,871	36,367	2,608	9,850	2,701	2,263	1,124	957
BUSINESS	14,191	10,502	0	3,600	0	0	89	0
CORPORATE	6,744	399	0	2,341	1,830	2,047	0	127
PERSONAL	11,784	11,176	0	594	0	0	15	0
AERIAL	2,863	0	2,608	60	0	0	195	0
INSTRUCTIONAL	3,835	3,676	0	114	0	0	45	0
AIR TAXI	5,403	1,459	0	2,269	810	108	216	540
OTHER	11,051	9,155	0	872	61	108	564	290

1985

	TOTAL	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
TOTAL	59,626	38,684	2,667	10,552	2,958	2,597	1,176	1,001
BUSINESS	15,928	11,826	0	4,013	0	0	89	0
CORPORATE	7,412	418	0	2,456	2,055	2,356	0	128
PERSONAL	12,128	11,496	0	616	0	0	16	0
AERIAL	2,927	0	2,667	61	0	0	199	0
INSTRUCTIONAL	3,748	3,593	0	111	0	0	44	0
AIR TAXI	5,614	1,516	0	2,358	842	112	225	561
OTHER	11,868	9,836	0	937	61	119	604	312

TABLE B-8.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	18.937	24.666	49.030	41.322	2.971	130.885
1977	19.697	26.639	51.327	45.013	3.223	139.502
1978	20.584	29.080	53.700	49.450	3.509	149.305
1979	21.472	31.960	56.083	54.891	3.865	160.540
1980	22.401	35.183	58.581	61.017	4.261	172.922
1981	23.172	38.669	60.682	67.756	4.593	185.587
1982	23.840	42.212	62.524	74.661	5.127	198.110
1983	24.484	46.020	64.307	82.124	5.608	211.326
1984	25.202	50.085	66.275	90.090	6.117	225.534
1985	26.171	54.477	68.876	98.624	6.667	241.482

TABLE B-9.

FUEL CONSUMED (MILLION GALLONS) DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

	TOTAL	AV GAS	JET FUEL
1976	776	462	314
1977	851	499	352
1978	943	536	407
1979	1,051	580	471
1980	1,175	625	550
1981	1,312	672	640
1982	1,459	716	742
1983	1,505	765	840
1984	1,770	815	955
1985	1,949	867	1,082

TABLE B-10.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, 1985

1976	49,261,497
1977	52,475,422
1978	58,701,406
1979	65,824,399
1980	74,159,184
1981	83,616,517
1982	93,990,434
1983	104,250,955
1984	115,853,716
1985	128,437,836

SECTION B.3. LOW/HIGH ECONOMY COMPARISON

TABLE B-11.

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1975

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1976

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1977

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	1.42	0.00	0.90	0.00	0.00	1.18	0.00
CORPORATE	1.95	0.00	1.03	1.97	1.23	0.00	2.29
PERSONAL	0.81	0.00	1.45	0.00	0.00	1.09	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	-0.02	0.00	-0.02	-0.07	-0.02	-0.03	-0.03
OTHER	-0.09	0.00	-0.07	0.00	4.05	3.15	3.58

1978

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	3.59	0.00	2.45	0.00	0.00	2.38	0.00
CORPORATE	3.71	0.00	2.48	3.75	3.06	0.00	4.29
PERSONAL	1.62	0.00	2.91	0.00	0.00	2.20	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	2.53	0.00	2.53	2.48	2.52	2.52	2.52
OTHER	3.40	0.00	3.41	0.00	7.04	5.66	6.32

TABLE B-11. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE, DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1979

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	6.12	0.00	4.43	0.00	0.00	3.59	0.00
CORPORATE	5.33	0.00	4.03	5.37	5.35	0.00	6.09
PERSONAL	2.44	0.00	4.39	0.00	0.00	3.31	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	5.03	0.00	5.03	4.99	5.03	5.03	5.03
OTHER	6.48	0.00	6.49	0.00	9.39	7.77	8.56

1980

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	8.92	0.00	6.65	0.00	0.00	4.81	0.00
CORPORATE	6.82	0.00	5.55	6.86	6.98	0.00	7.69
PERSONAL	3.26	0.00	5.89	0.00	0.00	4.44	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	7.32	0.00	7.32	7.28	7.32	7.31	7.31
OTHER	9.26	0.00	9.28	0.00	11.32	9.59	10.44

1981

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	11.63	0.00	9.04	0.00	0.00	6.05	0.00
CORPORATE	8.21	0.00	7.00	8.26	8.78	0.00	9.18
PERSONAL	4.09	0.00	7.42	0.00	0.00	5.58	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	9.63	0.00	9.63	9.59	9.63	9.62	9.62
OTHER	11.88	0.00	11.89	0.00	12.98	11.19	12.08

1982

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	15.92	0.00	12.44	0.00	0.00	8.38	0.00
CORPORATE	11.05	0.00	9.18	11.12	11.28	0.00	12.27
PERSONAL	5.08	0.00	9.24	0.00	0.00	6.93	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	11.85	0.00	11.84	11.76	11.84	11.83	11.83
OTHER	14.35	0.00	14.37	0.00	16.98	14.81	15.89

TABLE B-11. (Cont.)

ACTIVE AIRCRAFT BY PRIMARY USE. DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR. AS PERCENT OF BASELINE. 1985

1983

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	21.05	0.00	16.52	0.00	0.00	10.79	0.00
CORPORATE	13.82	0.00	11.66	13.90	14.11	0.00	15.27
PERSONAL	6.08	0.00	11.09	0.00	0.00	8.31	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	16.69	0.00	16.59	16.61	16.58	16.68	16.68
OTHER	17.35	0.00	17.37	0.00	20.57	18.20	19.44

1984

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	26.69	0.00	21.09	0.00	0.00	13.22	0.00
CORPORATE	16.49	0.00	14.24	16.58	17.06	0.00	18.13
PERSONAL	7.09	0.00	12.98	0.00	0.00	9.70	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	21.07	0.00	21.07	20.99	21.07	21.06	21.06
OTHER	20.31	0.00	20.32	0.00	24.08	21.38	22.73

1985

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	32.75	0.00	26.05	0.00	0.00	15.72	0.00
CORPORATE	19.10	0.00	16.83	19.20	20.03	0.00	20.90
PERSONAL	8.10	0.00	14.90	0.00	0.00	11.11	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	25.77	0.00	25.77	25.69	25.77	25.76	25.76
OTHER	23.27	0.00	23.29	0.00	27.29	24.41	25.86

TABLE B-12.

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1975

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1976

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CORPORATE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERSONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1977

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	1.01	0.00	0.49	0.00	0.00	0.03	0.00
CORPORATE	1.53	0.00	0.62	1.97	1.23	0.00	1.12
PERSONAL	0.81	0.00	1.45	0.00	0.00	1.09	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	2.55	0.00	2.55	2.55	2.55	2.55	2.55
OTHER	3.47	0.00	3.47	0.00	4.05	3.15	3.58

1978

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PPOP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	2.75	0.00	1.62	0.00	0.00	0.05	0.00
CORPORATE	2.87	0.00	1.65	3.75	3.06	0.00	1.92
PERSONAL	1.62	0.00	2.91	0.00	0.00	2.20	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	5.05	0.00	5.05	5.05	5.05	5.05	5.05
OTHER	6.55	0.00	6.55	0.00	7.04	5.66	6.32

TABLE B-12. (Cont.)

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1979

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	4.83	0.00	3.16	0.00	0.00	0.07	0.00
CORPORATE	4.05	0.00	2.77	5.37	5.05	0.00	2.47
PERSONAL	2.44	0.00	4.39	0.00	0.00	3.31	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	7.34	0.00	7.34	7.34	7.34	7.34	7.34
OTHER	9.32	0.00	9.32	0.00	9.39	7.77	8.56

1980

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	7.06	0.00	4.93	0.00	0.00	0.09	0.00
CORPORATE	5.09	0.00	3.85	6.86	6.98	0.00	2.84
PERSONAL	3.26	0.00	5.89	0.00	0.00	4.44	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	9.65	0.00	9.65	9.65	9.65	9.65	9.65
OTHER	11.93	0.00	11.93	0.00	11.32	9.59	10.44

1981

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	9.38	0.00	6.85	0.00	0.00	0.11	0.00
CORPORATE	6.03	0.00	4.85	8.26	8.78	0.00	3.06
PERSONAL	4.09	0.00	7.42	0.00	0.00	5.58	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	11.88	0.00	11.88	11.88	11.98	11.88	11.88
OTHER	14.42	0.00	14.42	0.00	12.98	11.19	12.08

1952

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	12.74	0.00	9.35	0.00	0.00	0.16	0.00
CORPORATE	8.00	0.00	6.18	11.12	11.28	0.00	3.75
PERSONAL	5.08	0.00	9.24	0.00	0.00	6.93	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	16.72	0.00	16.72	16.72	16.72	16.72	16.72
OTHER	17.42	0.00	17.42	0.00	16.98	14.81	15.89

TABLE B-12. (Cont.)

HOURS FLOWN DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1983

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	16.83	0.00	12.46	0.00	0.00	0.20	0.00
CORPORATE	9.85	0.00	7.77	13.90	14.11	0.00	4.25
PERSONAL	6.08	0.00	11.39	0.00	0.00	8.31	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	21.11	0.00	21.11	21.11	21.11	21.11	21.11
OTHER	20.38	0.00	20.38	0.00	20.57	18.20	19.44

1984

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	21.36	0.00	16.00	0.00	0.00	0.23	0.00
CORPORATE	11.59	0.00	9.43	16.58	17.06	0.00	4.58
PERSONAL	7.09	0.00	12.98	0.00	0.00	9.70	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	25.81	0.00	25.81	25.81	25.81	25.81	25.81
OTHER	23.34	0.00	23.34	0.00	24.08	21.38	22.73

1985

	SNGL-P NON-AER	SNGL-P AER	MULTI-PISTON	TURBO PROP	TURBO JET	PISTON HELIC	TURBINE HELIC
BUSINESS	26.20	0.00	19.84	0.00	0.00	0.27	0.00
CORPORATE	13.23	0.00	11.07	19.20	20.03	0.00	4.76
PERSONAL	8.10	0.00	14.90	0.00	0.00	11.11	0.00
AERIAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTRUCTIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AIR TAXI	30.56	0.00	30.56	30.56	30.56	30.56	30.56
OTHER	26.31	0.00	26.31	0.00	27.29	24.41	25.86

TABLE B-13.

TOWERED AND NON-TOWERED OPERATIONS DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

	TOWERD LOCAL	TOWERD ITINERANT	NON-TOWERD LOCAL	NON-TOWERD ITINERANT	IFR ALL AIRPORTS	VFR ALL AIRPORTS
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.66	1.17	0.68	1.27	1.27	0.95
1978	1.43	2.61	1.46	2.84	2.83	2.10
1979	2.29	4.17	2.34	4.52	4.45	3.38
1980	3.23	5.82	3.29	6.28	6.17	4.76
1981	4.23	7.53	4.36	8.07	7.93	6.25
1982	5.59	10.10	5.79	10.82	10.63	8.41
1983	7.33	13.02	7.44	13.91	13.76	10.90
1984	9.13	16.18	9.27	17.24	17.08	13.63
1985	11.01	19.52	11.16	20.75	20.57	16.51

TABLE B-14.

FUEL CONSUMED DURING PREVIOUS YEAR, AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

	AV GAS	JET FUEL
1976	0.00	0.00
1977	1.22	1.70
1978	2.61	3.66
1979	4.09	5.63
1980	5.61	7.51
1981	7.20	9.25
1982	9.47	12.06
1983	11.99	15.02
1984	14.71	18.04
1985	17.53	21.03

TABLE B-15.

FEDERAL TAX REVENUE DURING PREVIOUS YEAR AS REPORTED ON JANUARY 1 OF DESIGNATED YEAR, AS PERCENT OF BASELINE, 1985

1976	0.00
1977	1.35
1978	3.03
1979	4.78
1980	6.54
1981	8.27
1982	10.89
1983	13.76
1984	16.77
1985	19.84